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by Shelly Phipps and Lynn Lethbridge

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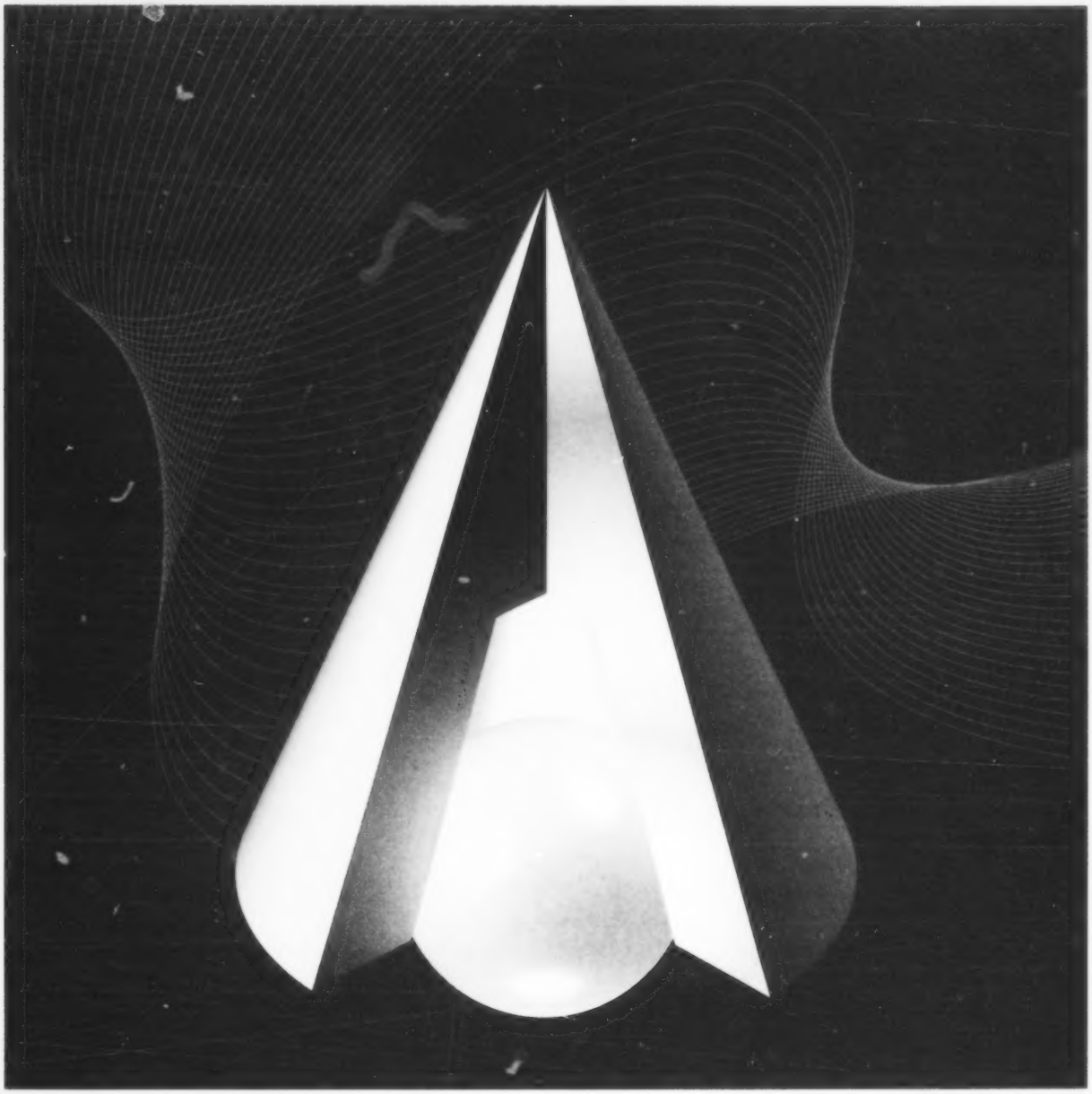

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Income and the Outcomes of Children

by

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Abstract

This report re-investigates the connection between income and child well-being for a broad range of outcomes. The report attempts to address four research questions:

1. Which measure of income is most appropriate to examine the relationship between income and child outcomes?
2. What is the functional form of the relationship between income and child outcomes?
3. Are associations between income and child outcomes larger for younger or older children?
4. Do income changes or income levels matter most for child outcomes?

In order to understand how income levels and/or income changes may affect children at different stages of development, regression equations are estimated using alternative income concepts and hypothesized functional forms.

The analysis uses data from the Statistics Canada National Longitudinal Survey of Children and Youth (NLSCY), cycles 1, 2 and 3[1]. The report focuses on the longitudinal sample of children who are present in all three cycles. This allows for a comparison of associations which exist between current measures of income and/or low-income status and current child outcomes with associations which exist between current outcomes and measures of past income. Analyses are conducted for a broad list of child outcomes which can be categorized into four developmental domains: 1) cognitive, 2) social/emotional, 3) physical, and 4) behavioural.

The major results derived from the regression analysis are summarized below:

1. Higher income is *almost always* associated with better outcomes for children. This is true regardless of the measure of income employed, the assumed functional form of the relationship between income and child outcomes, the age of the child, or the type of child outcome being studied. It is also apparently true using either the NLSCY or the Youth in Transition Survey (YITS)/Programme for International Student Assessment (PISA) data.
2. The *size* of the association between income and child outcomes varies with developmental domain. Thus, for example, income has particularly strong associations with cognitive outcomes (e.g., Peabody Picture Vocabulary Test (PPVT) scores or math and reading scores) and behavioural outcomes (e.g., hours spent watching television). Physical health outcomes also have quite consistent positive associations with family income. Associations are generally smallest with 'social/emotional' outcomes (though hyperactivity is an exception to this 'rule'). Again, descriptive evidence from the YITS/PISA are consistent with these findings.
3. A three-period average of family equivalent income consistently has the largest associations with child outcomes. This is true across almost all kinds of outcomes and all ages of children. It is also true for children living in married-couple or lone-mother families. Thus, in general, it appears advisable to use an income measure averaged over as many years as are available in the data.

[1] The NLSCY is funded by Human Resources and Social Development (Human Resources Development Canada at the time this paper was prepared) and is carried out in partnership with Statistics Canada.

4. The functional form of the relationship between family income and child outcomes varies considerably across developmental domains. Estimating an inappropriate functional form may lead a researcher to the (false) impression that income does not matter, so that it is important to test a variety of alternatives.
5. It is almost never true that beyond the low-income threshold, income is unimportant for children's outcomes. (Non-nested hypothesis tests reject 'low-income' specifications in favour of continuous income specifications in almost every case.)
6. While over half of the outcomes studied here increase more quickly with income at lower than at higher income levels, it is almost always true that there is not a ceiling above which income no longer matters for child outcomes.
7. The relationship between incomes and outcomes appears to 'flatten' out toward the linear for older as compared to younger children. Thus, increases in income at very low-income levels are particularly important for the youngest children.
8. We find little evidence of differences in the size of the income/outcome associations for children of different ages. However, only a subset of outcomes are measured identically across age groups.
9. For middle-aged and for older children, *changes* in family income appear to be less important for child outcomes than *levels* of family income. However, income changes are more important for younger children, particularly if they happen earlier in life (i.e., between 1994 and 1996 rather than between 1996 and 1998). Income 'ups and downs' are particularly important for child emotion scores, an outcome for which income levels appear to play a less important role.
10. Results using the Youth in Transition Survey show a positive correlation between socioeconomic status and child outcomes, in general. While income was not available in this survey at the time of analysis, direct comparisons by income are not possible. Therefore a proxy for income in a socioeconomic status (SES) index is used with outcomes which can be categorized into the same categorical domains as the NLSCY. It is interesting that the differences across SES quintiles are particularly large for outcomes in the cognitive and behavioural domains and somewhat smaller for social and emotional domains which fits with results obtained using the NLSCY.

Keywords: labour market participation, family income, cognitive outcomes, children, parenting skills

1. Introduction

While it is now well-established that there is a strong association between income and the well-being of adults, more controversy concerning the link between family income and child outcomes is apparent in the research literature. Canadian studies using the first cycle of the National Longitudinal Survey of Children and Youth (NLSCY) have found relationships between child outcomes and low-income status and/or family income which are small in magnitude or even insignificant (for example, see Curtis and Phipps, 2001; Dooley et al., 1998; Dooley and Curtis, 1998). These results appear contrary both to economic theory (e.g., Becker, 1974; Haveman and Wolfe, 1995), which clearly makes the case that income is a key input to children's well-being, and to general public discourse, which has been much concerned with the number of children in low-income households in recent years. Understanding the link between income and children's well-being is vital for policy formulation, as it could result in changes which could help transfer programmes become more efficient and effective.

This project will systematically re-investigate the connection between income and child outcomes. Specifically, we address four principal questions: 1) Which *measure* of income is most appropriate to examine the relationship between income and child outcomes? 2) What is the functional form of the relationship between income and child outcomes? 3) Are associations between income and child outcomes larger for younger or older children? 4) Do income changes or income levels matter most for child outcomes? As well, we always attempt to assess whether answers to these questions are the same for all kinds of child outcomes (e.g., cognitive, emotional, physical, behavioral).

In what follows, we provide a summary review of the literature; describe the data employed in the analysis; provide some basic descriptive statistics about child incomes and outcomes; address each of the above questions in turn; and summarize conclusions.

As will be outlined in the data section, the NLSCY is employed for much of this study. It can often be informative, however, to compare results using a different dataset or survey. The Youth in Transition Survey (YITS) allows for comparison of some basic descriptive evidence about the association between socioeconomic status (SES) and child outcomes. However, at the time of analysis, these data do not actually provide a measure of income, but rather an index representing SES. It is, therefore, not possible to carry out the same sort of detailed analysis as is the focus of the main body of the research reported here; nor is it possible to make more precise comparisons. Rather, we include these results to see if there is a general link between SES and child outcomes. As such, we include the YITS discussion in an Appendix of this report.

2. Literature review

This section of the report draws heavily upon our own past work (especially Hoddinott, Lethbridge and Phipps, 2002 and Phipps, 2003).

2.1 Theoretical models of why income should matter for child outcomes

Among economists, the most influential model of the determinants of children's well-being is one which focuses on how parental choices affect outcomes for children (see Becker and Tomes, 1986). For example, parents determine the level of economic resources available to the family by deciding

how much time to spend working for pay (and they have previously decided upon how much education to pursue, which is a determinant of their rate of pay). Parents then decide about how economic resources will be used—for adult consumption, for asset accumulation or for investments in children, where investments in children are "expenditures on their skills, health, learning, motivation, 'credentials,' and many other characteristics" (Becker and Tomes, 1986, p. S5). One key prediction of this approach is that children will fare better when families have more resources to invest in them.

Haveman and Wolfe's (1995) review sees the basic economic framework described above as being one of three factors that affect children's well-being. These are: 1) the choices made by society which will determine the options available to either children or their parents—what Haveman and Wolfe call "the social investment;" 2) the choices made by the parents about both the quality and quantity of resources devoted to children— "the parental investment;" and, 3) the choices made by the children themselves. This last component is seen to be most important for older children.

Researchers in other fields offer alternative theoretical perspectives. The 'socialization/role model perspective' focuses on the important influences of parents, siblings and peers on the development of children's aspirations, values and behaviour (Seltzer, 1994; Jencks and Mayer, 1990). The 'ecological systems' approach, favoured by many developmental psychologists, argues that development occurs throughout life, and that the timing and context of any significant life event (e.g., parental divorce) will modify its impact on that particular individual (e.g., Bronfenbrenner, 1989). Stress theory and coping strategy perspectives argue that a particular stressful event (again, for example, parental divorce) may change a child's equilibrium path of development though the impact of such a stressful event can be mitigated, or not, depending upon parental coping capacities (e.g., McCubbin, 1979). As Haveman and Wolfe argue, these psychological and sociological perspectives emphasize environmental/cultural factors rather than the individual choices/ characteristics upon which economists focus.

2.2 Survey of existing empirical evidence concerning the link between income level and child outcomes

Past research with the National Longitudinal Survey of Children and Youth (NLSCY) has concluded that children from low-income families generally experience worse outcomes than other children (e.g., Curtis and Phipps, 2000a; Kohen, Hertzman and Brooks-Gunn, 1998; Keating and Hertzman, 1999; Lipman and Offord, 1997; Ross, Roberts and Scott, 1998; Ryan and Adams, 1998). For example, Ross and Roberts (1999) present evidence from the 1994-1995 wave of the NLSCY that "more than one-third of children from low-income families exhibit delayed vocabulary development, compared to only 8% of children in high-income families" (p. 52). Ryan and Adams (1998) conclude "socioeconomic status has a large and pervasive influence over children's school achievement" (p. 3). Moreover, the finding that children from low-income families have worse outcomes than other children appears to be true for other countries as well (see Curtis and Phipps, 2001; Phipps, 1999b and 1999c; McLanahan and Sandfur, 1994; Brooks-Gunn and Duncan, 1997). However, there is much debate about the *magnitude*, and hence policy significance, of the association between socioeconomic status and child outcomes. Some recent Canadian studies that investigate the link between current household income or low-income status and child well-being find relationships that are small in magnitude or statistically insignificant (for example, see Curtis et al., 1998; Dooley and Curtis, 1998; and Dooley et al., 1998).

Findings of weak or non-existent associations between resources, such as household income, and child outcomes may reflect reliance, occasioned by the use of a single cross-section of data, on current income that may be a noisy indicator of long-term household resources, or 'permanent income.' Studies in the United States have argued that permanent income may be a better measure of economic resources in the context of studying the role of income as a determinant of children's well-being (see, especially, Blau 1999, Korenman et al., 1995, Mayer, 1997). The primary data source for this work has been the National Longitudinal Survey of Youth's (NLSY) Mother and Child Supplement that provides very long income histories. Yet, while there is a consensus that permanent income is more important than current income, there remains some disagreement about the magnitude of the effects.

Blau (1999) finds only small effects. He claims that the income effects are so small that income transfers to low-income families are likely to have very little impact on child development; "Policies that affect family income will have little direct impact on child development unless they result in very large and permanent changes in income." (p. 261). Korenman et al. (1995) interpret their results to indicate a 'moderate to large' effect of changes in long-term low-income status on children's cognitive development. Mayer (1997) reviews existing literature and uses several different methodologies and United States data sets and concludes that the effect of increases in parental income on child outcomes, ceteris paribus, "is nowhere near as large as many political liberals imagine, neither is it zero as many political conservatives seem to believe" (p. 143). She goes on to say that although the effect on any single outcome may be small, most outcomes seem to be affected by income to some extent; thus, increasing income may have a substantial *cumulative* impact. Until recently, Canadian studies of the link between child outcomes and family income have been limited by lack of data. Research using the provincial sample from the Ontario Child Health Study (OCHS), conducted in 1983 and 1987, indicate a consistently significant association between low income and psychiatric disorders (Offord, Boyle and Jones, 1987), social and educational functioning (Lipman and Offord, 1994), and chronic physical health problems (Cadman et al., 1986) in children. Studies using the longitudinal nature of the OCHS find that changes in income levels are very weakly correlated with changes in the levels of child health (Lipman, Offord and Boyle, 1994; and Boyle and Lipman, 1998). The studies that find a significant relationship between income and child health tend to limit the use of other explanatory variables.

Curtis et al. (2002) investigate the relationship between current low income and average low income using the OCHS. The study investigated the presence of emotional problems, cognitive problems, any health problems and an overall health-related quality of life score, the Health Utilities Index Mark 2 (HUI2). As in the Korenman study, children from low-income families suffered from substantially more problems than did children from non-low-income families. For cognitive problems, both current and average low incomes were negatively associated, though the effect was larger for average low-income. Curtis et al. (2002) conclude that child outcomes are more strongly related to average low income than current low income. Unlike results from the NLSY, they find that the magnitude of income effects to be 'large' for some outcomes.

Curtis and Phipps (2000b) re-examine the association between economic resources and children's health and success at school using the second wave of NLSCY data. This, again, makes it possible to move beyond *current* income and/or low-income status as a measure of the economic resources available to the child. This study also argues that it is possible that the effects of economic resources only appear with a lag; hence, it may be that previous years' income is more important than current income. Finally, it is also possible that duration of low-income status is important. These hypotheses are examined with the conclusion that for success at school, it is clearly the longer-term

low income and the two-period average of income that have the largest associations. Economists also argue that stocks of wealth, as well as income flows, are a vital component of the economic resources available to a family. While the NLSCY does not provide any direct information about family assets, a proxy for home ownership and for the state of repair of the family dwelling are included. Finally, time available is also an important resource for parents. Traditional economic reasoning also suggests that, holding income constant, families with more time are better off than those with less. When controls for both housing and available parental time per week are added, results suggest that children who live in owner-occupied housing have better outcomes than children who do not; children who live in housing in need of major repairs have worse outcomes. This represents an additional channel through which economic resources can influence outcomes for children. More hours of parental time available each week, income constant, significantly improves a child's success at school.

Using the third wave of the NLSCY data, Dooley et al. (1998) continue to find relatively small associations between child emotional/behavioural indicators and 3-period average measures of family income, but somewhat larger associations between these longer-term measures of family income and child cognitive outcomes (math and reading test scores from the second wave of data). They follow Mayer (1997) in examining the hypothesis that one pathway through which income influences outcomes for children may be that families with higher incomes are able to spend more in ways which are beneficial to the child (specifically, thus far, on recreational programmes, sports, clubs and lessons). While children's participation in recreational programmes has strong associations with family income, their preliminary work suggests that the associations between participation in recreation and other outcomes for children are relatively small. Thus, the preliminary conclusion is that higher income, leading to increased 'investment' in recreational programmes, is not a particularly important pathway through which income may influence child cognitive outcomes.

An important potential problem in the analysis of the linkages which exist between family income and child outcomes is that of 'unobserved heterogeneity.' That is, unobserved characteristics, such as intelligence, energy or motivation, are associated both with higher family income and with better outcomes for children; so that if we find a connection between family income and child outcomes it may not really be a 'true effect.'

Using United States data, Duncan et al. (1994) estimate a 'change' model to address the potential problem of unobserved heterogeneity (i.e., the possibility that some unobservable factor, such as intelligence, drive or motivation, may be correlated with both child outcomes and family income). Specifically, they find that the change in IQ measure between ages 3 and 5 has a highly statistically significant relationship with the change in parental income over the same period. This methodology still has the potential problem that whatever *caused* the income change may also have caused the developmental change. Mayer (1997) tests for possible omitted-variable bias by including measures of parental income *after* the outcome in question was measured (hence arguing that the outcome could not have been caused by the income). She finds that the estimated impact of income is much smaller in this case. A problem is that families may well have anticipated future income, and adjusted consumption or other behaviours accordingly (e.g., individuals about to finish medical school).

Another approach to solving the unobserved heterogeneity problem is to use sibling differences, the approach employed by Duncan et al. (1998) using Panel Study of Income Dynamics (PSID) data. Results again suggest that family income is particularly important for cognitive outcomes: family

income is most important during the early years; and the association between income and child outcomes is non-linear, with income being most important for the lowest income children (see also Smith et al., 1997).

Dooley and Stewart (2004) also use the first three cycles of NLSCY data to study connections between family income and child cognitive outcomes (PPVT (Peabody Picture Vocabulary Test), math and reading scores), paying particular attention to the issue of unobserved heterogeneity. Although they attempt a variety of possible solutions for this problem, Dooley and Stewart conclude that with only three cycles of the NLSCY currently available, it is still really too early to 'solve' the problem using the NLSCY. Given this caveat, their findings indicate that while some part of the observed income effect may be due to unobserved heterogeneity, this is not the 'full story.' Income does still really appear to matter, though the associations are quite small.

2.3 Income changes and child outcomes

Work by Picot et al. (1999), using longitudinal microdata from the Survey of Labour and Income Dynamics (SLID) for 1993 and 1994, demonstrates that it is not unlikely that children will face changes—sometimes quite dramatic changes--in family income. These authors conclude that changes in family composition (e.g., divorce/separation or re-marriage of parents) have the largest impact on the probability of a child entering or leaving low-income status, respectively. While changing labour market circumstances (e.g., gaining or losing a job) do not have nearly so dramatic an association with the probability of a child changing low-income status, they are much more common. Picot et al. (1999) conclude that changing family composition and labour market changes are about equally responsible for children moving into, and out of, low income in Canada.

There are relatively few Canadian studies that address the consequences of transitions or 'shocks' to family socioeconomic status for children's educational attainments. Kohen et al. (2000) is an exception. They use the second wave of the NLSCY and Structural Equation Modelling techniques to study the consequences of unemployment and/or a drop in family income (of 25% or more) on current pre-schooler PPVT scores. Kohen et al. (2000) argue that unemployment can lead to financial hardship and many forms of stress in the household (e.g., parental stress, parental ill health/depression, marital discord) any of which may lead to poorer outcomes for children. These authors present descriptive evidence that the PPVT scores for children in dual earner families were 12 points higher (4/5th of a standard deviation) than children who lived with 2 parents neither of whom had paid work. This pattern holds in multivariate analysis—that is, children with two unemployed parents (or children in lone-parent households whose parent is unemployed) or children who experience significant drops in family income have worse PPVT scores than other children. The effects of parental unemployment are mediated somewhat, though they remain strong, through maternal mental health, family functioning and, especially, positive parenting behaviour.

It is worth noting that, as argued above, 'coping strategy' and 'stress theory' perspectives suggest that negative life circumstances or vulnerabilities may be offset if parents or children have healthy coping strategies which help them to 'cushion the blows.' In addition to the Kohen et al. (2000) study, which emphasizes maternal mental health, family functioning and positive parenting behaviour as mediators of negative economic shocks, some cross-sectional work is helpful in pointing to variables which may help promote resiliency of children who are particularly vulnerable. Jenkins and Keating (1998) emphasize the role played by close relationships, particularly with adults other than parents, as well as sibling and peer relationships, in helping children cope with

particularly stressful circumstances. Ross, Roberts and Scott (1998) again emphasize the mediating role of parenting behaviour, in this case for children in lone-parent families. Landy and Tam (1998) once again emphasize parenting practices and social support in helping children cope with multiple-risk situations.

2.4 Critical periods in child development

While economists have paid less attention to the idea that the impact of a negative life event experienced by a child may depend upon *when* in the child's life it occurs (though see Danziger and Waldfogel, 2000), scholars in other disciplines argue that this can be extremely important (Duncan et al., 1998). There is much emphasis placed on what occurs during the 'early years' of development both because this affects biological pathways and because development is a cumulative process so that outcomes/attainments at any age can have important consequences for opportunities and capacities at subsequent ages (e.g., Hertzman, 2000; Mustard, McCain and Bertrand, 2000).

With respect to the importance of 'critical periods,' Duncan and Brooks-Gunn (1997), conclude: "Family economic conditions in early and middle childhood appeared to be far more important for shaping ability and achievement than were economic conditions during adolescence." (p. 597). This conclusion was based on the results of a coordinated analysis by 12 groups of researchers, working with 10 different developmental data sets, most of which offered longitudinal measurement of family income as well as measurements of the achievement of children at various points in life. This points to the need for the analysis of the determinants of the attainments to be undertaken for separate age cohorts.

Hoddinott, Lethbridge and Phipps (2002) use three cycles of the NLSCY to ask whether 'history is destiny'? That is, they estimate the extent to which past attainments predict future attainments and to what extent transition events can alter/mediate developmental pathways. The focus of the study is upon cognitive outcomes (e.g., PPVT, math and reading scores). Significant evidence of persistence in child outcomes is apparent—children observed in the bottom quintile of child attainments in 1994 are highly likely to remain in the lowest attainment group when observed four years later (in 1998). This persistence is robust, in multivariate analysis, to the inclusion of a wide variety of child, parental and household characteristics. A particularly important point made by Hoddinott, Lethbridge and Phipps is that socioeconomic status in early childhood is very important, both because the size of the association is largest at this stage *and* because problems developed early in life can 'snowball' through the persistence effects noted above into larger problems later in life.

2.5 Summary

To summarize the research evidence to date on the linkages between child health status and family socioeconomic conditions:

1) there is a consensus that children with lower socioeconomic status have poorer health outcomes, but there remains disagreement about the magnitude of the associations;
2) there are larger associations between longer-term measures of family socioeconomic status and children's current well-being;
3) the *timing* of spells of low income matters, with what happens in the earliest years being critical;

4) income appears to affect children in a non-linear fashion (i.e., being particularly important for lowest-income children);
5) while income *level* is most important, shocks are also important, though negative shocks may have larger impacts than positive shocks;
6) paying attention to family time and family assets, as well as family income, is important for understanding the link between income and child outcomes;
7) mediating variables, such as parenting style, good relationships and high-quality schools, can help to offset the consequences either of vulnerable starting points or negative shocks.

3. *Data*[2]

We address the research questions described in the introduction using the National Longitudinal Survey of Children and Youth (NLSCY). The NLSCY is an ongoing survey of Canadian children, designed to help analyze child development and well-being. There were 3 cycles of data available at the time of analysis, with interviews in 1994, 1996 and 1998 and the expectation of continued biennial interviews until the children reach the age of 25. In addition to the longitudinal file, cross-sectional data are available for each survey year yielding nationally representative results when the sampling weights are applied. In 1994, the sample was of children 0 to 11 years of age, in 1996, 0 to 13 years and in 1998, 0 to 15 years. Additional children are added to the cross-sectional file each survey year in order to maintain a nationally and provincially representative sample for that year.

The sample for the NLSCY was originally drawn from the Labour Force Survey (a monthly survey by Statistics Canada used to produce labour force information). The survey uses a multistage probability sample, where each province is an independent sample. Through stratification, cities, small urban areas and rural areas are broken down into clusters of dwellings from which households are surveyed. From the Labour Force Survey (LFS), households containing children could be selected for the NLSCY. Note that the LFS excludes those living in institutions and on Indian reserves. In cycle one, 22,831 children were interviewed which included about 5,000 children from households of those in the National Population Health Study. These children were dropped from the second cycle due to budget constraints. In cycle one, up to four children per household were interviewed but by cycle two, only two children per household were interviewed (for those households with more than two children, those interviewed were randomly selected). Again, this was due to budget constraints. However, there was a large increase in the number of 0- to 5-year-old children interviewed, due in part to an increase in 2- to 5-year-olds interviewed in New Brunswick, as part of a special project, leading to a total sample of 20,025 children in cycle two. For cycle three, no new siblings of children already in the survey were interviewed (as they were in cycle two) but new children selected from the Labour Force Survey households and birth registries increased the sample size of children aged 0 to 15 years to 31,194.

There are two sampling weights available for the NLSCY; one is a longitudinal weight and the other a cross-sectional weight. In this study, we use the longitudinal weights. These weights are derived using a series of adjustments to an initial (or basic) weight using a cascading procedure. The basic weight is approximately equal to the inverse of the probability of selection into the sample. An adjustment factor accounts for non-response which "...involves an attempt to consolidate those individuals with the same propensity to respond. These groups are formed using the characteristics

2. As previously noted in the introduction, the Youth in Transition Survey is used in this study. For a discussion of the data, please see Appendix 2.

for each child reported in Cycle 1" (Statistics Canada, 2001, p. 49). A further weighting is applied to ensure consistency between survey estimates and known demographic characteristics by province, sex and age.

In this study, we focus on the longitudinal sample. Thus, we select only children who are present for all of the three cycles, implying children in our sample are 0 to 11 years in 1994 and 4 to 15 years in 1998. A total of 14,169 children are present in all three cycles. We exclude children where the Person Most Knowledgeable (PMK) has changed during the three cycles and a small number of children in lone-father households, leaving a total of 12,150 for our sample. Finally, there are some outcomes where the information is missing for a small number of children. Children are included for any of the outcomes where information is available.

To assess whether or not there may be differences in the relationship between income and child outcomes for children of different ages, we have divided children into three age groups: the 'smallest' children who are aged 4 to 7 in 1998; the 'middle-aged' children who are 8 to 11 in 1998; and the 'biggest' children who are 12 to 15 in 1998. This implies, of course, that in 1994 the children would have been aged 0 to 3, 4 to 7 and 8 to 11 years, respectively. This division is convenient both because it fits appropriately with the age differences in questions asked about children in the NLSCY and because it provides a reasonable breakdown by developmental stages. That is, we can assess the role of income experiences during the pre-school/school entry phase, during the early school years and during early teen years.

For some parts of our analysis, we focus on two samples of children whose parents have unchanged marital status throughout the study period: 1) those who have lived with both parents throughout the study period; and, 2) those who have lived with a lone mother throughout the study period. Other work has indicated that changes in family structure are among the most important determinants of family income. As well, divorce/re-marriage also involves non-income related stress for children and their parents, which would be difficult to separate from the income changes at the same time. As such, we feel that studying only children who have not experienced a change in family structure will give us the 'cleanest' understanding of the link between income and child outcomes.[3] Throughout the paper, we often emphasize results for children in married-couple households. This is not to suggest children in lone-mother households are not affected, but rather that sample sizes may be too small for some groupings to draw reliable conclusions.

Readers should note that throughout this paper, the standard errors have been calculated using the standard formula with a clustering adjustment to account for non-independence among respondents, as siblings can appear in the data. This does not, however, account for the complex survey design of the NLSCY. The formula used to calculate standard errors assumes a random sample design but the NLSCY, like many Statistics Canada surveys, is a multi-staged, stratified survey design for which there is no exact standard error formula. Statistics Canada has recently begun to recommend estimating the standard error using the bootstrap replication method.[4] Bootstrap weights for each cycle of the NLSCY are now provided by Statistics Canada which enables users to estimate the variances (and therefore, the standard errors) to account for the complex survey design. When the estimation for this report began, these weights were not available so the standard methods were used. Given the sampling design of surveying households within clusters which were randomly

3. We exclude children who experienced a change in family structure in 1996 or 1998.
4. See Rao and Wu (1988) for a discussion of the bootstrap procedure.

selected from within strata, standard errors may be underestimated and, therefore, statistical significance over-estimated. Note further, however, that bootstrapping will particularly affect imprecisely estimated coefficients which are often not statistically significant whether estimated using standard procedures or not. Readers may want to view results in this paper which are significant with 90% confidence with some caution as bootstrapped standard errors may be larger resulting in statistical insignificance for some coefficients.

4. *Descriptive evidence about income, child outcomes and low-income experiences*

4.1 Conceptual and measurement issues

In general, economists would argue that income averaged across as many periods as are available in the data (in our case, a three-period average) should be the best choice as a measure of income. A three-period average can help to 'net out' possible measurement error and will provide the best representation of the average level of resources which have been available to the child over the past four years. That is, an average measure of income using the longest time horizon available will provide the best possible measure of a family's 'permanent income'; hence, it is generally regarded as the most appropriate measure to use in studies of associations between child outcomes and income. Thus, we estimate associations between our set of child outcomes and a three-period average measure of income (i.e., an average over 1994, 1996 and 1998, with all values expressed in 1998 dollars).

Of course, two families may have had the same average income, but in one case, income may have remained constant (in real 1998 $ terms) across the study period, while in another, it may vary considerably (e.g., $40,000; $40,000; $40,000 and $10,000; $80,000; $30,000 have the same mean). The implications for children's well-being may not be the same in the two cases, and hence we compare results using a three-period average with results which also include a measure of income variability (i.e., the coefficient of variation calculated for each child across the three time periods).

To the extent that capital markets are not perfect and income is not substitutable across time periods, it is possible that the *lowest* income experienced in any time period operates as a 'binding constraint' and hence is particularly important for child outcomes. To consider this possibility, we examine the relationship between child outcomes and the *minimum* income (in real 1998 $ terms) experienced over the three periods.

The arguments above notwithstanding, a case could nonetheless also be made that for some outcomes, *current* family income is likely to be the most important for *current* child outcomes. For example, a child who does not have enough to eat today may do less well at school; low levels of income today may generate emotional stress for the child today. This possibility is examined through the inclusion of current (i.e., 1998) income in one set of estimating equations. These estimates also provide a useful comparison of results which would be obtained if researchers only had access to cross-sectional data with those obtained when researchers can track family income over a longer time horizon.

Finally, it could be the case that past income (i.e., 1994) is most important, since developmental implications only occur with a lag. For example, if family income has only recently fallen, it may

take some time before a less nutritious diet results in an increase in body mass index; or, it may take some time before consequences of restricted family resources show up in measurable reductions in a child's math or reading scores. An emphasis on the importance of past income would also be consistent with the idea that income is developmentally extremely important in a child's earlier years (e.g., because of 'critical periods' in child development or simply because low income earlier in life places the child on a disadvantaged developmental pathway which is hard to change later with potentially off-setting increases in family income).

A final important point to make is that it is entirely possible that decisions about which is 'the best' measure of income to use will vary depending upon the child outcome being studied.

The relationships between child outcomes and low income measured against alternative time horizons are also considered. For example, we can contrast associations found between current child outcomes and current child low income; current child outcomes and past child low income (e.g., 1994 low income) and current child outcomes and the full history of child low income (i.e., was the household in low income once, twice or in all three periods for which we have data).

The income measure available to us in the National Longitudinal Survey of Children and Youth (NLSCY) is based on questions asked of the 'person most knowledgeable (PMK)' about the child (generally a parent and generally the mother). In 1994 and 1996, the PMK was simply asked "What is your best estimate of the total income before taxes and deductions of all household members from all sources in the past 12 months?" The survey is not timed to coincide with tax time, and it was generally conducted during an in-home interview (lasting about two hours). In 7.5% of cases (in 1996), the spouse of the PMK also contributed information.

Although an after-tax measure of income would provide a better measure of economic resources actually available to families, this is not available in the NLSCY.[5] However, it is possible and important to adjust total household income for family size using an appropriate equivalence scale. The idea is that families of different sizes living with the same dollar income will have quite different standards of living because 'two cannot live as cheaply as one.' However, simply dividing family income by the number of people present is not appropriate because family members can share important items (such as the kitchen, heating, telephone). In this work, we consistently use the Luxembourg Income Study (LIS) scale to calculate 'equivalent income.' The LIS scale is calculated as the square root of family size. Thus, for example, a family of four would have an equivalence scale equal to 2; if living with a family income of $50,000, they would be judged to have the same equivalent income, or purchasing power as a single individual with an income of $25,000 (i.e., $50,000/2).

4.2 Descriptive evidence about income and low income

Table 1 reports a range of alternative measures of income, reflecting the conceptual discussion above. First, we report incomes separately for all children in the sample, for all children living with married parents throughout the study period and for all children living with lone mothers throughout the study period. We next report incomes separately by child's age group, maintaining the break-

5. Research focussed on the distribution of well-being *within* families suggests that we should, ideally, pay attention to how resources are shared/used within the family; that it may matter whether it is the mother or the father who receives the income. This is beyond the scope of this project (and not entirely feasible with the income information available in the NLSCY).

downs by marital status. (Recall that the child age groups are 4 to 7 years in 1998—the 'small' children, 8 to 11 years in 1998 or the 'middle-aged' children, and 12 to 15 years in 1998 or the 'big' children.) Consistent with the discussion above, alternative income measures considered here include: 1) current equivalent income (i.e., 1998); 2) past equivalent income (i.e., 1994); 3) a 3-year average equivalent income; and, 4) the minimum equivalent income experienced in any of the three years. All incomes are reported in 1998 dollars. Finally, to assess the extent of variation across the three time periods, we report the average coefficient of variation.[6]

Table 1 also presents information about children's *relative* socioeconomic status. That is, we illustrate how children fit into the Canadian income distribution. To do this, we report, by child age and marital status, percentages of children whose family income would place them among the bottom 20% of Canadians, the second to the bottom 20% of Canadians, etc. Microdata from the Survey of Consumer Finance (SCF) for 1994, 1996 and 1998 are used to calculate cut-offs which separate quintiles of the before-tax, after-transfer equivalent income distribution for all individuals in Canada (i.e., each individual in the SCF is assigned the appropriate equivalent income for his/her family, given a Luxembourg Income Study equivalence scale). We use the SCF rather than the NLSCY to compute quintile cut points, so that we are gauging children's incomes relative to all Canadians rather than relative to all Canadian children. In order to report how children's three-period average income fits into the Canadian distribution, we compare the child's three-period average income, with quintile cutoffs constructed as a straight average of the 1994, 1996 and 1998 cutoffs.

Finally, Table 1 provides two alternative measures of low-income status. The first is simply experience of low income in 1998—a measure of deprivation which pays no attention to past economic resources. Low income is measured using a relative concept whereby, a household is counted as having low income if equivalent household income is below one-half the median equivalent income for all individuals in the country. We again used microdata from the SCF to calculate a low-income line relative to all incomes in the country (rather than just relative to children's incomes). The second measure of low income makes use of longitudinal information by counting the number of times (of a possible three periods for which we have data) that the child is observed as being in low income.

Turning to Table 1, consider, first, estimates of average 1998 equivalent income (reported in the first row of the table). For all children in our sample, average equivalent income is $30,451.[7] Children whose parents remained married throughout the study period have a higher than average current income ($33,814) while children who lived with a lone mother throughout the sample period have, on average, current incomes which are roughly *half* the average ($15,457). This first key point about the striking economic disadvantage of children living with lone mothers persists in all income comparisons we make. A second point to note about current incomes is that the smallest children have, on average, incomes which are about $2000 less than the middle-aged children ($28,388 versus $30,563); the middle-aged children have incomes which are, on average, about $2,000 less than the biggest children ($30,563 versus $32,367). This is to be expected as parents are older, typically with more labour market experience and thus somewhat higher earnings.

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6. That is, for each child, we construct a coefficient of variation over the three observations on real family income, then calculate the average coefficient of variation across all children.
7. Again, recall that this is *equivalent* income which means that we have divided actual gross income (including transfers) by the LIS equivalence scale to adjust for differences in need for families of different sizes. Although we always use equivalent income, for ease of exposition we will sometimes refer simply to 'income.'

If we compare current incomes for 1994 (in 1998 dollars) with current incomes for 1998, it is clear that family incomes have, on average, increased in real terms over the period for all groups considered. Some of this is, again, due to aging of parents (who would have four additional years of labour market experience by 1998). However, part of the gain is also due to improved labour market conditions for parents. As a rough illustration of this point, notice that the 1994 real average income of children in the middle-aged group ($25,985), was lower than the 1998 incomes of children in the youngest group ($28,388). (We make this comparison because the 'middle-aged' group would have been aged 4 to 7 in 1994 while the youngest group are aged 4 to 7 in 1998.) It is, then, not surprising that three-period average incomes are in between 1994 and 1998 incomes.

Table 1 also reports the average value of minimum incomes experienced across the three periods. Notice that, for all children, 'minimum' income is 16.5% lower than 1994 income. This indicates that not all families with children follow a smoothly increasing income path—many families face significant 'ups and downs' in the resources available to them. This point is also highlighted by the coefficient of variation means presented in the last row of the top panel of Table 1. It is noticeable here that children living with lone mothers throughout the sample period experience more volatility in family income than children living with married couples (though the difference is smaller for the oldest group of children).

The second panel of Table 1 first illustrates where three-period average family income would place the children in our sample within the overall Canadian distribution of income. For the full sample, children are most likely to be at the bottom of the distribution (with family equivalent incomes less than $15,814) and least likely to be at the top (with family equivalent incomes greater than $46,083). Thus, while, by definition, 20% of all Canadians are found in each quintile, 24.0% of children in our sample are located in the bottom quintile versus 13.3% in the top quintile. Patterns are again rather different for children living with married couples compared to children living with lone mothers. Thus, the second and third quintiles of the Canadian income distribution are the most common places to be for children living with married couples (26.3% and 26.7%, respectively). On the other hand, again emphasizing the serious economic hardship experienced by children living with lone mothers, an overwhelming 70.3% of children in lone-mother families are located in the bottom income quintile versus less than 1% in the top quintile.

Finally, Table 1 reports the incidence of low income in 1998, as well as the number of low-income occurrences observed over the sample period. Overall, we find 18.6% of all children in our sample to be low income in 1998; 10.2% of children living in two-parent families and 59.5% of children living in lone-mother families. Across the age groupings, low income is highest for the youngest group of children and lowest for the oldest group of children and this basic pattern is true (despite enormous differences in levels of low income) regardless of marital status.

Since being in a low-income household in only one year may have rather different consequences for child outcomes than long-term low income, we also consider the number of years in which the child is reported to be in low income. Fortunately, the majority of children in all our age groups have not experienced any periods of low income (65.3% for the full sample). Of course, this means that 34.7% of all children in our sample have experienced at least one low-income year during our study period. This is almost twice as high as the annual estimate of low income for 1998 (i.e., 18.6%). Thus, more children are touched by low-income at some point in their lives than would be predicted on the basis of low-income estimates for a single year. In general, of those who have experienced any low-income years, it is most common to have been in low income for one year only. Note, however, that nearly 11% of children were in low-income households for all three cycles of the

survey. And, it is once again important to point out the starkly different experiences of children living in lone-mother families, *over half* of whom have lived in low-income households throughout the study period.

4.3 Child outcomes

4.3.1 Conceptual and measurement issues

Throughout this paper, we have chosen to study outcomes as reported in the 1998 cycle. This allows us to compare associations which exist between *current* measures of income and/or low-income status and *current* child outcomes (e.g., 1998 income and 1998 outcomes) with associations which exist between current outcomes and the alternative measures of *past* income as described above. Since one of our goals is to examine how the association between income and child outcomes may vary for different kinds of child outcomes, we have chosen to study a rather extensive list of outcomes. Moreover, given the comparative focus of our research, we have chosen to study child outcomes that are measured continuously (rather than in categories). This allows us to normalize (by subtracting the mean and dividing by the standard deviation), so that all outcomes have a mean equal to zero and a standard deviation of one.[8] Thus, we can make comparative statements such as, for example, "the same percentage increase in income results in an increase of 1 standard deviation from the mean for outcome 'x' but an increase of only one-half of a standard deviation for outcome 'y.' Choosing continuous measures of child outcomes also means that we can use the same estimation method for each outcome studied. This also facilitates the cross-outcome comparative analysis which is our goal in this research. For the younger and 'middle-aged' children, the survey information used here was provided by the 'person most knowledgeable' (PMK) about the child (generally the mother). For the older children, questions were generally asked of the children themselves.

With these caveats in mind, we have chosen outcomes from four different developmental domains: 1) cognitive; 2) social/emotional; 3) physical; and 4) behavioural. Since in the NLSCY, not all indicators are available or even appropriate for all age groups, there is some variation in the specific outcomes used to represent these domains across the three age groups. (See Appendix 1 for a detailed description of the indices used in this report.)

The first cognitive outcome we study is the Peabody Picture Vocabulary Score (PPVT) which is available for 4-, 5- and some 6-year-olds in 1998. The PPVT measures receptive or hearing vocabulary and is used as a measure of school readiness (Statistics Canada, 1998). The test was administered by the NLSCY interviewer. We use PPVT scores which have been standardized by age. For all older children in our sample, we study math and reading scores. Math and reading tests were administered at the child's school by the teacher (see Appendix 1 for details). The raw scores are standardized to obtain a classical derived scale score to reflect the progression of scores throughout the grade levels. The math and reading scores are grade-standardized rather than age-standardized (for a further discussion of the standardizing for cycle three, see Statistics Canada, 1998). Note that a potential advantage of these scores is that they are arguably more 'objective' measures than some of the other measures we study here which rely upon parent or child assessments and could thus be biased (e.g., either parent or child could be embarrassed to admit to

8. We normalize within age groups so that for all children in that age group the mean = 0 and the standard deviation =1. This facilitates comparisons across outcomes for children of the same age, but not across age groups.

certain kinds of problems or could, alternatively, overstate problems because they are currently depressed).

Outcomes chosen as examples from the social/emotional domain include, first, a pro-social score where a higher score indicates the presence of more pro-social behaviour (such as showing sympathy to someone who has made a mistake; helping someone who has been hurt; volunteering to help clean up a mess someone else has made; comforting another child). The pro-social score is available in 1998 for all age groups in our sample (with the difference that the PMK answers the questions for the 4- to 7- and 8- to 11-year-old children while the child answers for himself/herself for the 12- to 15-year-olds). We also study an emotional disorder variable, where a high score indicates the presence of emotional disorder behaviours (e.g., 'How often would you say your child seems to be unhappy, sad or depressed?'). Again, the PMK answers questions about younger children; older children answer for themselves.

For children aged 8 to 11 years, we have a measure of conduct disorder/physical aggression derived from PMK responses to questions such as: "How often does your child get into fights?" "How often does your child kick, bite or hit other children?" A higher score indicates more physically aggressive behaviour. For older children, we employ an index of indirect aggression based on responses to questions asked of the children themselves such as: "When I am mad at someone, I say bad things behind his/her back." Again, a higher score indicates higher levels of indirect aggression.

An index of hyperactivity is available for all age groups in our sample. The score is constructed from questions such as: "How often would you say that your child can't sit still, is restless or hyperactive?" "How often would you say that your child is distractable, has trouble sticking to any activity?" "How often would you say that your child fidgets?" A higher score indicates the presence of more hyperactivity/inattentive behaviour. For the younger children, PMKs answered the relevant questions; for older children, the responses were provided by the children themselves.

For the older children (i.e., aged 12 to 15 years in 1998), we are able to use a derived 'friends' index which is based on responses provided by the children (e.g., 'I have many friends.' 'I get along well with others my age.' Most others my age like me'). And, for the older children, we are also able to study a self-esteem score, again based on responses provided by the children themselves (e.g., 'In general, I like the way I am.' 'Overall, I have a lot to be proud of.'). Thus, a higher value on the view of self score indicates a more positive self-image.

We also consider the association between income and a child's physical health. Here, we use two indicators for each age group. First, we study the body mass index (BMI), calculated as weight (in kilograms) divided by height (in metres) squared. While it is more common in the literature to study obesity (e.g., having a BMI greater than the 95th percentile), in order to facilitate the comparative analyses which are the goal of this paper, we have chosen to use the continuous BMI, standardized by age and sex. Evidence in the literature makes a clear connection between being overweight as a child and being overweight as an adult and, moreover, finds links between obesity and, for example, type II diabetes and heart disease.

We also study the McMaster Health Utilities Index (HUI). The HUI is a health status index, developed by researchers at McMaster University, which makes use of both qualitative and quantitative information about health status. Eight attributes are incorporated: vision, hearing, speech, mobility, dexterity, cognition, emotion, and pain and discomfort. HUI scores range from 0

to 1, with 1 representing high overall health status. In the case of this outcome only, we make use of outcomes from 1996 rather than 1998 because the questions required to construct the HUI were only asked in 1996 for children aged 6 through 15. (A decision has been taken by Statistics Canada to compute a HUI only once for each child; HUI's were calculated for 4- and 5-year-old children in 1998, but we do not make use of these data in this work).

We have labelled the final domain studied in this report as 'behavioural.' Here, we include the number of hours spent watching television as well as a derived 'property offences' score. For the two younger groups of children, we use the property offences score which is constructed from PMK responses to questions such as: "How often would you say that your child destroys his/her own things?" "How often would you say that your child vandalizes?" "How often would you say that your child tells lies or cheats?" For the oldest children, the property offences score is based on children's own responses to questions such as: "I destroy my own things." "I steal at home." "I tell lies or cheat." "I vandalize." In both cases, higher values for the property offences score indicate more property offences.

4.3.2 Descriptive evidence about child outcomes

To provide a preliminary indication of the link we find between various child outcomes and family income, Tables 2a, 2b and 2c simply report mean normalized outcome scores for children in each quintile of the Canadian income distribution.[9] (A separate table is provided for each age group.) We also report mean outcome scores for children who were in low income versus children who were not in low income in 1998; and mean normalized scores for children who had, respectively, experienced no low income over the study period versus those who had experienced low income once, twice or three times. The main message to take from Tables 2a, 2b and 2c, and one which will be re-iterated throughout this report, is that for most outcomes studied, a clear association with income is apparent. For example, consider the normalized PPVT scores for the youngest children (principally 4- and 5-year-olds in 1998): children in the lowest income quintile had PPVT scores which were about one-third of a standard deviation below the group mean (- 0.345) while children in the highest income quintile had PPVT scores which were about one-half of a standard deviation above the group mean (+0.552). Similar very strong patterns are apparent for all cognitive outcomes and for all age groups.

Within the rather broad 'social/emotional' domain, we generally also find clear associations between income and the various child outcomes studied, though the *magnitude* of the association is smaller than is apparent for the cognitive scores. For example, for 8- to 11-year-old children, those whose family equivalent income places them in the bottom quintile of the Canadian distribution have hyperactivity scores which are 0.17 of a standard deviation higher than average while children with family incomes in the top quintile have hyperactivity scores which are one-third of a standard deviation lower than the group mean. While clearly suggesting an association with income, the size of the association is smaller than, for example, the association with reading scores (0.340 less than mean for children in the bottom quintile versus 0.452 higher than the mean for children in the top quintile).

One case where there appears to be very little in the way of an association between income and child outcomes is for emotion and pro-social scores for the youngest children. Notice, however,

9. In this table, we simply use 3-period average equivalent family income; our discussion of whether this is the most appropriate measure of income to use follows.

that an association between income and these outcomes seems to emerge as the children age (though it is never as large as for some other outcomes).

Associations between aspects of physical health status and income are also clearly apparent (though again, somewhat muted by comparison with the cognitive score outcomes). For example, children aged 8 to 11 years in the lowest income quintile have age/sex adjusted BMI's which are 0.155 of a standard deviation higher than the mean; children in the highest income quintile have standardized BMI scores which are 0.153 of a standard deviation lower than the mean.

Finally, important associations between child behaviour and income are also apparent (and may, in future research, be important for understanding pathways through which income is associated with child well-being). For example, the lowest income 8- to 11-year-old children are reported by their PMKs to watch 0.246 of a standard deviation more hours of television than the group mean while the most affluent children are reported to watch 0.332 of a standard deviation less than the mean. This is one of the largest associations observed, aside from the cognitive outcomes.

An important point to notice from Table 2c is that these relationships between income and child outcomes are not only apparent when we use outcomes reported by the PMK, but also when the child himself/herself answers survey questions. Thus, for example, the self-esteem measure is 0.115 of a standard deviation lower than the mean for the most underprivileged children and 0.285 of a standard deviation higher than the mean for the most affluent children.

A final observation about the numbers presented in Tables 2a, 2b and 2c is that they provide a preliminary indication that the relationship between child outcomes and income does not always have the same shape. For example, there is a symmetry apparent in reading scores for 12- to 15-year-olds, insofar as the amount by which low-income children have *lower* than average scores (i.e., - 0.246 of a standard deviation) is almost the same as the amount by which affluent children have *higher* scores (i.e., + 0.256 of a standard deviation). On the other hand, the amount by which hyperactivity scores are lower for affluent 12-to-15-year-old children (-0.317) is three times the amount by which hyperactivity scores are higher for poorer children (0.107).

Tables 2a, 2b and 2c also report mean normalized child outcome scores for children who are in low income versus not in 1998. Rather clearly, these children have worse outcomes across the entire set of outcomes considered here and across the three age groups studied. Moreover, children who have experienced long-term low income (e.g., in two or especially three periods) have much worse outcomes than other children.

Tables 3a, 3b and 3c report an equivalent set of child outcome means by family income group for children who have lived in married-couple families throughout the full study period.[10] Essentially the same patterns are apparent. We are unable to report such a table for children who have lived in lone-mother families throughout the sample period since the small sample size involved raises issues of confidentiality.

10. That is, we observe them to be living in a married-couple family in 1994, 1996 and 1998.

5. *Research questions*

We turn now to the four principal questions addressed in this research: 1) Which *measure* of income is most appropriate to measure the relationship between income and child outcomes? 2) What is the functional form of the relationship between income and child outcomes? 3) Are associations between income and child outcomes larger for younger or older children? 4) Do income changes or income levels matter most? We always also ask whether answers to these questions are the same for all kinds of child outcomes (e.g., cognitive, emotional, physical, behavioral)?

5.1 Question 1: Which measure of income is most appropriate to measure the relationship between income and child outcomes?

In order to address the question of which *measure* of income has the largest association with child outcomes, we have estimated ordinary least squares (OLS) regressions[11] for each outcome studied, for each age group and separately for children living in married-couple versus lone-mother families using four alternative measures of family equivalent income: 1) current income (i.e., 1998 income); 2) lagged income (i.e., 1994 income); 3) minimum income over the three periods; 4) 3-period average income.[12] Longitudinal weights are employed, and since siblings can appear in the data, we have adjusted standard errors to take account of non-independence of these observations (using the 'cluster' command in Stata). For the purposes of this first set of regressions, we report only coefficients from a logarithmic functional form for income together with the robust standard errors.[13]

A first point to take from these tables (especially Table 4a), is the number of 'stars' indicating the statistical significance of income. Table 4a reports estimated coefficients on the log of income for 136 regressions—income is statistically significant in 104 cases. A second point is that, given the way we have normalized the outcome scores, it is legitimate to compare the magnitude of estimated coefficients across outcomes, but within age categories (we *cannot* compare magnitudes of coefficients across age groups). Reinforcing the message from the previous section, it is apparent that, for each age group of children, cognitive outcomes have some of the largest associations with income. However, the hyperactivity score, BMI (body mass index), and television hours also have large associations.[14]

Finally, the third point to take from Tables 4a and 4b, and the real focus of this section, is that the 3-period average income has very consistently the largest association with child outcomes (and this

11. OLS is, arguably, not the best functional form for estimation of some of the scores which may have a large number of zeroes of very skewed distributions. A more detailed study of a smaller number of outcomes could and should take such issues into account. We do not do so here.
12. We also estimated models which included 3-period average income plus the coefficient of variation over the three periods. In almost all cases, the coefficient of variation was insignificant and so we dropped this specification.
13. Note that throughout the report we refer to variables as being statistically significant or insignificant. An important aspect of this report is to study the statistical relationship between income and a broad range of outcomes using varying functional forms, readers should keep in mind, though, that variables may have a statistically significant association yet a small effect.
14. There are fewer apparent significant associations between income and child outcomes for lone-parent families. However, since we have divided children into 3 age groups, we are left with less than 300 observations for most regressions with the lone-mother data. Such small sample sizes may well help to explain the lack of precision in these estimates. Small samples also mean that most of the rest of the analysis done in this project is focussed upon children living with married couples.

is true for children living in either family structure). The only outcomes for which this is not the case are the pro-social score (where lagged income and minimum income have larger associations), the emotion score (where lagged income generally has a larger association), and, for the oldest children, standardized BMI which has a larger association with lagged income. Thus, we find a quite striking degree of consistency in favour of using the 3-period average measure of income, and so for the remainder of this project, we focus on results obtained using the 3-period average measure of family equivalent income.[15]

5.2 Question 2: What is the functional form of the relationship between income and child outcomes?

We consider a range of alternative functional forms for the relationship between family equivalent income and child outcomes. A first, perhaps most basic specification simply includes a set of indicators for the number of times that the family is in low income over the study period. Simply including low-income indicators is consistent with a hypothesis that deprivation matters, but that beyond the low-income threshold, further increases in income do not have an important association with child outcomes. Notice that implicit in this specification is the assumption that all non-low-income households have the same child outcome score.

A second specification involves a series of dummies to indicate the quintile of the Canadian income distribution into which the child's family equivalent income falls. In this case, the implicit assumption is that children within each quintile of the income distribution have the same outcome scores, but that scores can change as we move across quintiles. Thus, we are now allowing for incomes above the low-income threshold to have associations with child outcome scores. An advantage of this specification is that the association between income and child outcomes is not forced to be linear. For example, it could be that scores are low for low-income children, higher for middle-income children and lower again for the highest-income children. Alternatively, it could be that scores consistently increase as income increases but that the magnitude of the change in the scores is not consistent across different ranges of income. For example, there could be larger increases associated with moving from the bottom quintile to the second quintile than are associated with moving from the fourth quintile to the top quintile.

In a sense, however, we are 'throwing away information' when we reduce income information to a categorical representation and we also consider a variety of continuous functional forms. First, a linear specification is appropriate, if the outcome score increases at a constant rate with income, regardless of the level of income. For example, an increase in income from $10,000 to $20,000 would be associated with the same increase in child outcome scores as an increase from $90,000 to $100,000. A quadratic specification allows for the possibility that the child outcomes increase with income, but that the rate of increase is slower (or faster) at higher-income levels than at lower-income levels. A cubic functional form allows for even more flexibility in the pattern of the relationship between child outcome score and income. For example, a cubic specification could allow for outcomes to improve quickly with income over low ranges, to level off for middle income, and then to 'take off' again at higher incomes. Finally, a logarithmic specification (i.e., the level of the outcome score estimated as a linear function of the log of income) assumes that the child outcome score increases at a constant rate with proportional changes in income (e.g., doubling

15. Regressions using all four measures of income (+ the cv form) were also run using linear, quadratic, and cubic specifications. The same conclusion—that the 3-period average measure of income has the largest associations was—reached in each case.

income always has the same effect so that, for example, an increase from $10,000 to $20,000 would be associated with the same increase in the child outcome score as an increase from $50,000 to $100,000).

Tables 5a, 5b and 5c report the results of estimating each of the above alternative functional forms for each child outcome using 3-period average equivalent family income [16] for children living with married couples.[17]

In order to decide which is the 'best' functional form for each outcome, we consider a series of statistical tests. First, we use a Ramsey 'Reset' test as a general test of functional form for the continuous measures of income (see Wooldridge, 2003, p. 292). Any specifications rejected on the basis of the Reset test are eliminated from further consideration (in many cases, this leaves more than one possibility—see Table 6). Second, since the linear form is 'nested' in the quadratic and the quadratic is 'nested' in the cubic, testing of these alternatives against one another is straightforward. That is, if the quadratic term is significant (using a simple t-test), then we reject the linear form in favour of the quadratic. If the cubic term is significant, then we reject the quadratic in favour of the cubic. This further narrows the set of appropriate 'contenders.'

Finally, testing the other functional forms against one another (e.g., the log form against the linear, quadratic or cubic or any of the 'categorical' forms against any other specifications) involves 'non-nested' hypothesis testing. We use a non-nested test proposed by Mizon and Richard (1986) and described in Wooldridge (2003) which simply involves estimating a comprehensive model with both income forms included. If, for example, we are testing the linear form against the log, we re-estimate each model including both income and the log of income in the regression. Then, if, for example, we find the linear form to be insignificant (using a simple t-test) while the log form is significant, then we conclude that the log form is preferred to the linear. In some cases, of course, the results of the non-nested tests are inconclusive—it can be the case that neither form remains significant when both are included in the model or that both remain significant. In this case, neither form is eliminated from further consideration. Table 7 summarizes the 'best case' functional form for each outcome and age group.[18]

A first general point to take from this set of tables is again that income almost always matters — regardless of the exact nature of the assumed functional form of the relationship between income and child outcomes. Thus, in summary Table 7, 'no apparent relationship' occurs in only 4 of 36 cases.

A second important point is, however, that it is often possible to come to the wrong conclusion about whether or not there is a relationship between income if we estimate the wrong functional form. For example, for children in the youngest age group, there appears to be no relationship between income and math scores, if we specify a linear relationship, but there is a relationship if we use a quadratic or logarithmic function (see Table 5a). Thus, it is important for researchers to consider a variety of alternatives for any particular outcome.

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16. Again, we have actually estimated each functional form using every measure of income considered above. In the interests of space, we do not report all of these results here. However, in general, it seemed to be the case that the 'best' functional form for a particular outcome was the same regardless of the measure of income being used.
17. Recall that small sample sizes will not allow detailed analysis of functional form for the lone-mother sample.
18. In the interests of avoiding tedium and saving space, we do not present all the results of the non-nested hypothesis testing. These are, of course, available upon request from the authors.

Third, in all but one case (math scores for 4- to 7-year-olds) the set of dummy variables indicating the number of times a child has experienced low income are rejected in non-nested hypothesis tests by one of the continuous functional forms. Thus, it is almost never true that there is a 'ceiling' above which additional income will no longer be beneficial for children. Although the quintile specification is not generally the 'best' functional form, it is useful for illustrating that gains are still associated with being in the top compared with the fourth quintile. Note that one reason the 'top quintile' coefficient is often rather large is very likely that the difference in incomes between Family A with just enough income to make it into the top quintile (e.g., about $50,000) and Family B toward the top of this quintile (e.g., $120,000) is larger than the difference in incomes between Family A and some of the lowest-income families in the country (e.g., $5,000).

On the other hand, it is very common to find that an income transfer to a lower-income family will lead to larger gains in child outcomes than the same dollar transfer to a more affluent family. This conclusion is basically only *not* true when the linear specification is preferred. As indicated in Table 7 for children living with married couples, a linear specification is strictly preferred in 9 out of 30 cases for which income matters; the linear specification is preferred or cannot be rejected in 14 out of 30 cases. Thus, in a majority of cases, income matters *most* for families who have least, though it still matters at higher-income levels.

The linear form, which assumes that a dollar will have the same impact on child outcomes whether received by a high- or low-income family, is more often the 'best' specification for older children. Thus, for 7 of the 11 outcomes for which we find a statistically significant relationship with income, the linear specification is strictly preferred for this age group. The linear specification is strictly preferred or cannot be rejected for 10 out of 11 cases. By comparison, for the youngest age group, the linear specification is *never* strictly preferred, and cannot be rejected for only two of the nine outcomes for which we find a relationship with income. Thus, there appears to be a 'flattening out' of the relationship between income and child outcomes as children age.

Figures 1 through 4 provide further illustration of the implications of choice of functional form. For equivalent income ranges from $5,000 to $50,000 (90% of our households have incomes less than $50,000), we illustrate estimated income/outcome associations for math scores and BMI. Figures 1 and 2, respectively, illustrate math scores and BMI for the 4-to-7-year-old group while Figures 3 and 4 illustrate the same two income/outcome associations for the oldest children. The graphs illustrate estimated linear, quadratic, cubic and logarithmic relationships. Recall from Table 7 that for math scores, the quadratic or logarithmic forms are preferred for the youngest group of children. If, instead, we had used a linear association, we would have a very incorrect understanding of the 'steepness' of the relationship between income and outcome at low-income levels (i.e., we might underestimate the potential importance of income gains for very low-income families), and might make an incorrect policy decision. For older children, the linear or log are the preferred functional forms. A comparison of Figures 1 and 3 emphasizes the point made above about the apparent 'flattening out' of the income/outcome relationship for older children. Figures 2 and 4 illustrate the various estimated functional forms for the BMI/income relationship for the youngest and oldest children, respectively.

Finally, these general points notwithstanding, it is quite clear from Table 7 that the 'best' functional form varies across outcomes and age groups of children so that researchers should always make an effort to test for the most appropriate form for any outcome they are studying.

5.3 Question 3. Are associations between income and child outcomes larger for younger or older children?

The National Longitudinal Survey of Children and Youth (NLSCY), rather unfortunately, provides only very limited opportunities for directly addressing this question since there are relatively few outcomes which are entirely comparable across age categories. Even many of what appear to be the same measures, for example, switch the respondent from Person Most Knowledgeable (PMK) to child in the case of older children, which can lead to very significant differences in reported scores (see Curtis, Dooley and Phipps, 2000). Outcomes are most comparable for children in the 4 to 11 age range (in 1998). Of the outcomes studied here, we are able to test for significant differences in the size of the income effect for 4- to 7-year-old children compared to 8- to 11-year- old children for reading scores, math scores, the pro-social score, emotion score, aggression score, hyperactivity score, BMI, HUI (Health Utilities Index) and hours of television as reported by the PMK.

The approach taken is: 1) combine children from the two age groups (re-normalizing the scores for the expanded age group); 2) re-estimate the log specification of the child outcome equations using ordinary least squares; 3) add to the specification a dummy variable indicating membership in the 'middle-aged' group as well as an interaction term between the 'middle-age' dummy and the log of family equivalent income.[19] A t-test of the statistical significance of the coefficient on the interaction term is then a test of the hypothesis that income effects differ across age groups. We do not report a full set of results, since these interaction terms were nearly all statistically insignificant. One exception was for the emotion score (where the coefficient on log income itself was *insignificant*, p=0.386 while the interaction between log income and 'middle-aged child' was significant and negative (-0.149; p=0.082)). Thus, middle-aged children are found to have fewer emotional problems as income increases, while there is no apparent association for the youngest children. A second exception was for television hours, where a negative association is apparent between income and TV hours (-0.438; p=0.000) but this association is *smaller* for the middle-aged children (0.186; p=0.020).

For the 8- to 15-year-old children, the only comparisons we can make across age groups is for the math and reading scores, the HUI, and for self-reported hours of television.[20] Using the approach described above, we find evidence of age differences in the magnitude of the income effect in only one case: for math scores, the size of the income association for 'middle-aged' children is smaller than for older children (-5.45e-06; p=0.025).[21]

19. We again focus upon a 3-period average measure of family equivalent income.
20. Children aged 12 and over are asked to report their own heights and weights, meaning there is a noticeable reduction in measured BMI at this point (see (Phipps et al. (2004) for a discussion on parental over-reporting of child's height), presumably since young teens, like adults, slightly under-estimate their own weights because they want to be slim (see, for example, Wang et al., 2002).
21. The same conclusion holds for children in lone-mother families.

One caveat to these results is, however, that in order to test whether the size of the income association is the same for different age groups, we have had to choose the *same* functional form for both groups. However, as noted above, one of the most significant differences across age groups appears to be that the form of the income/child outcome relationship changes with the age of the child.

5.4 Question 4: Do income changes or income levels matter most for child outcomes?

To address this question, we have estimated yet one more set of regressions[22] in which we include 1994 equivalent income plus a set of dummy variables to indicate that the child's family experienced: a) a real income gain greater than 10% between 1994 and 1996; b) a real income loss greater than 10% between 1994 and 1996; c) a real income gain greater than 10% between 1996 and 1998; or, d) a real income loss greater than 10% between 1996 and 1998.

One general conclusion is that income changes are almost never statistically significant in the regressions for the oldest or the middle-aged children while the level of income is almost always very significant (and recall that there is also less variability in income for older children—e.g., coefficient of variation = 23.11 for the oldest group compared to 24.99 for the youngest group—see Table 1). This is consistent with some of the findings in the literature surveyed earlier in the paper. For the youngest children, on the other hand, while income levels remain vital, income changes can also be important. For 7 of the 11 outcomes, at least one of the change dummies is statistically significant with the 'expected sign' (that is, if income goes up, child outcomes improve and vice versa).[23] It also appears that significant family income changes which happen earlier in the child's life (i.e., between 1994 and 1996 rather than between 1996 and 1998) are more likely to have a significant association with outcome scores. As well, *increases* rather than decreases in income (between 1994 and 1996) are most likely to be significant. This finding is surprising, given other work in this area and may be the result of inadequately controlling for changes in family equivalent income which result from changes in family size (e.g., due to the birth of a new baby) that would reduce equivalent income when there has been no change in actual income. Finally, it is interesting that while there was no apparent association between the level of family equivalent income and the experience of emotional problems by the youngest children, the 'ups and downs' of family income are more important than for any other outcome.

Non-response

In most survey data, non-response issues can affect whether the population represented is accurate. There are two major forms of non-response. Firstly, selected individuals may refuse to participate in the survey or, in the case of longitudinal surveys, individuals may begin the survey but then drop out at a later stage. For this type of non-response (unit non-response) in the NLSCY, sampling weights are adjusted by increasing the weights of the participating households separately for geographic areas called balancing units. The assumption is the characteristics of those in each geographic area will be similar for the non-responding and responding households (Statistics Canada, 1998). As Hoddinott et al. (2002) show, differences in characteristics between those who

22. We address the question much less thoroughly than the first three questions. Additional research on this topic is certainly warranted.
23. The only exception is for the pro-social score. In this case, an increase in real income between 1994 and 1996 is associated with less pro-social behaviour.

remain in the survey and those who drop out are insignificant in multivariate analysis when longitudinal sample weights are employed. Since we use these weights for all analyses reported here, this form of non-response is unlikely to be a problem.

A second form of non-response is "item non-response." This occurs when individuals agree to participate in the survey, but refuse to answer or do not know the answer to individual questions. In this study, our focus is on the association between household income and child outcomes, so systematic problems of non-response to income or child outcome questions could potentially be a problem.

A particular problem with all surveys which attempt to determine household income is that many individuals refuse to answer and the NLSCY is no exception in this regard. In 1996, for example, 23% of observations were missing income information. Statistics Canada deals with this problem by imputing a plausible value when the income question is not answered. A "hot-deck" procedure is employed whereby the income of a household with similar socioeconomic characteristics is given to each non-responding household (Statistics Canada, 1998); households with an imputed income are indicated with a flag. In past research (Curtis and Phipps, 2000a), we carried out a careful examination of the importance of income imputation to conclusions about the links between income/low income and child outcomes. In general, conclusions were not substantively affected. Thus, in this research, we simply use reported and imputed family incomes equivalently.

The final way in which non-response may be a problem for our analysis is through non-response to questions about child outcomes. In particular, our results could be biased if, for example, lower-income households were systematically more likely not to report child outcomes. To test for this possibility, we estimate probit models of the probability of not reporting a child outcome as a function of 3-period average household income and other relevant controls. This is repeated for each outcome studied. We run each model separately for married households and lone-mother households and for each of the three age groups. A positive coefficient on the income variable would indicate that higher-income households are less likely to respond to the particular child outcome while a negative coefficient indicates lower-income households are less likely to respond. If the income variable is insignificant, of course, then there is no association.

Out of the 52 models which converged, (i.e., there were enough observations with missing values to run the probit model), 29 showed an insignificant coefficient on the income variable, 15 had a negative coefficient and 8 had a positive coefficient. For most outcomes then, there is an insignificant relationship between income and item non-response. For those outcomes where the relationship is negative, our conclusion that income is negatively associated with child outcomes may actually be understated. If a higher proportion of the non-response households are in low income and have poorer outcomes, then our results are less precisely estimated and may lead to insignificant results. Finally, it should be noted that seven of the eight positive results are for lone-mother households in the 4 to 7 age group. Results indicating a positive association between income and child outcomes may be overstated for this group.

One final note of caution, the math and reading non-response rate is very high. For each age group, the non-response is around 50%. This is due partly to the fact that schools and households had to consent to these tests. As noted by Statistics Canada, there were a variety of reasons for non-response. "Nevertheless, it is unlikely all these factors had the same effect on potential bias" (Statistics Canada, 1998, p. 153).

6. Conclusions

This report re-investigates the connection between income and child well-being through a broad range of children. The report attempts to address four research questions:

1. Which measure of income is most appropriate to examine the relationship between income and child outcomes?
2. What is the functional form of the relationship between income and child outcomes?
3. Are associations between income and child outcomes larger for younger or older children?
4. Do income changes or income levels matter most for child outcomes?

In order to understand how income levels and/or income changes may affect children at various stages of development, regression equations are estimated using alternative income concepts and hypothesized functional forms. The report includes a broad list of child outcomes which can be categorized into four developmental domains: 1) cognitive, 2) social/emotional, 3) physical, and 4) behavioural.

The main conclusions from the study can be summarized as follows:

1. Higher income is *almost always* associated with better outcomes for children. This is true regardless of the measure of income employed, the assumed functional form of the relationship between income and child outcomes, the age of the child, or the type of child outcome being studied. It is also apparently true using either the National Longitudinal Survey of Children and Youth (NLSCY) or the Youth in Transition Survey/Programme for International Student Assessment (YITS/PISA) data.

2. The *size* of the association between income and child outcomes varies with developmental domain. Thus, for example, income has particularly strong associations with cognitive outcomes (e.g., Peabody Picture Vocabulary Test (PPVT) scores or math and reading scores) and behavioural outcomes (e.g., hours spent watching television). Physical health outcomes also have quite consistent positive associations with family income. Associations are generally smallest with 'social/emotional' outcomes (though hyperactivity is an exception to this 'rule'). Again, descriptive evidence from the YITS/PISA are consistent with these findings.

3. A three-period average of family equivalent income consistently has the largest associations with child outcomes. This is true across almost all kinds of outcomes and all ages of children. It is also true for children living in married-couple or lone-mother families. Thus, in general, it appears advisable to use an income measure averaged over as many years as are available in the data.

4. The functional form of the relationship between family income and child outcomes varies considerably across developmental domains. Estimating an inappropriate functional form may lead a researcher to the (false) impression that income does not matter, so that it is important to test a variety of alternatives.

5. It is almost never true that beyond the low-income threshold, income is unimportant for children's outcomes. (Non-nested hypothesis tests reject 'low-income' specifications in favour of continuous income specifications in almost every case.)

6. While over half of the outcomes studied here increase more quickly with income at lower- than at higher-income levels, it is almost always true that there is not a ceiling above which income no longer matters for child outcomes.

7. The relationship between incomes and outcomes appears to 'flatten' out toward the linear for older as compared to younger children. Thus, increases in income at very low-income levels are particularly important for the youngest children.

8. Some general comparisons across age groups can be made across age groups in this paper. We find little evidence of differences in the size of the income/outcome associations for children of different ages. However, only a subset of outcomes are measured identically across age groups.

9. For middle-aged and for older children, *changes* in family income appear to be less important for child outcomes than *levels* of family income. However, income changes are more important for younger children, particularly if they happen earlier in life (i.e., between 1994 and 1996 rather than between 1996 and 1998). Income 'ups and downs' are particularly important for child emotion scores, an outcome for which income levels appear to play a less important role.

10. Results using the Youth in Transition Survey show a positive correlation between socioeconomic status and child outcomes, in general. While income was not available in this survey at the time of analysis, direct comparisons by income are not possible. Therefore, a proxy for income in an socioeconomic status (SES) index is used with outcomes which can be categorized into the same categorical domains as the NLSCY. It is interesting that the differences across SES quintiles are particularly large for outcomes in the cognitive and behavioural domains and somewhat smaller for social and emotional domains which fits with results obtained using the NLSCY.

Table 1 Mean family income (1998$) of children in the NLSCY sample, by marital status and by child's age group

	All ages			Ages 4 to 7			Ages 8 to 11			Ages 12 to 15		
	All	Marr.	Lone	All	Marr.	Lone	All	Marr.	Lone	All	Marr.	Lone
1998 income	30,451	33,814	15,457	28,388	31,780	12,230	30,563	33,990	16,387	32,367	35,583	16,989
1994 income	26,495	29,135	13,659	25,752	28,388	11,952	25,985	28,908	13,429	27,728	30,058	15,174
3-period average	27,884	30,855	14,335	26,564	29,564	11,916	27,581	30,691	14,644	29,482	32,242	15,863
3-period minimum	22,117	24,868	11,481	20,996	23,806	9,183	21,869	24,781	11,600	23,461	25,956	13,104
3- period coefficient of variation	24.11	21.90	23.64	24.99	22.60	25.51	24.24	21.70	24.19	23.11	21.44	21.67
Place in income distribution (3-period average)												
% in quintile 1	24.0%	15.1%	70.3%	25.8%	15.4%	82.3%	26.0%	17.4%	68.8%	20.2%	12.5%	62.6%
% in quintile 2	23.1%	26.3%	16.2%	27.2%	28.8%	11.1%	26.1%	25.8%	16.6%	25.1%	24.5%	19.8%
% in quintile 3	22.5%	26.7%	9.1%	21.7%	25.2%	5.0%	23.1%	26.3%	9.8%	25.5%	28.7%	11.3%
% in quintile 4	18.8%	18.3%	3.6%	15.3%	18.4%	NR	14.5%	17.3%	NR	16.7%	19.4%	4.9%
% in quintile 5	13.3%	13.5%	0.8%	10.0%	12.3%	NR	10.4%	13.2%	NR	12.5%	14.9%	1.4%
% in low income in 1998	18.6%	10.2%	59.5%	21.5%	11.4%	75.0%	18.6%	11.0%	53.5%	15.9%	8.4%	53.5%
Number of times in low income over the three cycles												
0	65.3%	76.1%	22.7%	62.2%	74.0%	12.5%	63.3%	74.1%	24.4%	70.3%	80.1%	28.7%
1	13.3%	11.8%	9.6%	14.2%	13.2%	6.2%	13.7%	12.1%	11.1%	12.0%	10.1%	10.8%
2	10.5%	7.5%	16.8%	10.8%	7.7%	18.7%	12.2%	8.9%	17.4%	8.7%	5.9%	14.9%
3	10.9%	4.6%	50.9%	12.8%	5.1%	62.6%	10.9%	4.9%	47.1%	9.1%	3.9%	45.7%

Notes: NR = not released due to small sample size

Income is adjusted for family size using the Luxembourg Income Study equivalence scale (i.e., household income is divided by the square root of the number of people in the house). A household is considered in low income if equivalent income is below ½ the median equivalent income for the country.

Quintile cutoffs for 1994 (1998 $): cutoff 1=16,210; cutoff 2=24,601; cutoff 3=33,381; cutoff 4=45,980.

Quintile cutoffs for 1998 (Survey of Consumer Finance in 1997 inflated to 1998 $): cutoff 1=15,814; cutoff 2=24,566; cutoff 3=33,602; cutoff 4=46,172.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 2a Mean values (normalized) of outcome scores of children aged 4 to 7 years, by family income levels

	PPVT[1]	Reading	Math	Pro-social	Aggression	Emotional disorder	Hyper-active	BMI[2]	HUI[3] 1996	Hours of TV	Property offences
3-period income											
quintile 1	-0.345	-0.314	-0.335	-0.075	0.083	0.028	0.137	0.101	-0.130	0.269	0.106
quintile 2	-0.120	-0.021	0.130	-0.002	0.078	-0.010	0.019	0.076	-0.041	0.137	0.051
quintile 3	0.103	0.109	-0.063	0.095	-0.043	-0.028	-0.025	-0.044	0.082	-0.105	-0.062
quintile 4	0.235	0.099	0.109	0.035	-0.096	-0.019	-0.019	-0.085	0.132	-0.237	-0.032
quintile 5	0.552	0.271	0.318	-0.070	-0.164	0.050	-0.205	-0.191	0.065	-0.410	-0.203
Current low income											
low income 1998	-0.316	-0.181	-0.436	-0.104	0.135	0.052	0.153	0.040	-0.118	0.333	0.144
high income 1998	0.084	0.035	0.085	0.027	-0.035	-0.014	-0.040	-0.010	0.031	-0.084	-0.037
Number of times in low income											
3	-0.382	-0.109	-0.611	-0.187	0.174	0.032	0.181	0.114	-0.213	0.395	0.162
2	-0.378	-0.426	-0.327	0.028	-0.009	0.029	0.134	0.165	-0.059	0.212	0.055
1	-0.132	-0.196	0.075	0.029	0.042	-0.047	0.025	0.013	0.075	0.073	0.045
0	0.165	0.112	0.124	0.024	-0.040	-0.001	-0.061	-0.049	0.038	-0.123	-0.049

1. Peabody Picture Vocabulary Test
2. Body Mass Index
3. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 2b Mean values (normalized) of outcome scores of children aged 8 to 11 years, by family income levels

	Reading	Math	Pro-social	Aggression	Emotional disorder	Hyper-active	BMI[1]	HUI[2] 1996	Hours of TV-mom	Hours of TV-self	Property offences
3-period income											
quintile 1	-0.340	-0.237	-0.095	0.127	0.132	0.176	0.155	-0.179	0.246	0.168	0.184
quintile 2	-0.115	-0.083	-0.108	0.090	0.036	0.062	0.023	-0.019	-0.007	-0.024	0.088
quintile 3	0.185	0.114	0.074	0.039	-0.011	0.009	-0.050	0.046	0.023	-0.033	-0.039
quintile 4	0.136	0.169	0.128	-0.230	-0.147	-0.179	-0.089	0.122	-0.215	-0.162	-0.193
quintile 5	0.452	0.224	0.127	-0.252	-0.150	-0.301	-0.153	0.217	-0.332	-0.020	-0.263
Current low income											
low income 1998	-0.305	-0.326	-0.003	0.078	0.097	0.175	0.169	-0.195	0.202	0.108	0.111
high income 1998	0.061	0.066	0.001	-0.016	-0.020	-0.035	-0.032	0.044	-0.043	-0.022	0.023
Number of times in low income											
3	-0.455	-0.408	-0.041	0.120	0.098	0.266	0.185	-0.335	0.326	0.257	0.214
2	-0.159	-0.133	-0.115	0.146	0.127	0.109	0.144	-0.071	0.179	-0.048	0.130
1	-0.034	-0.038	-0.023	0.063	0.140	0.090	-0.015	0.013	-0.040	0.148	0.125
0	0.109	0.097	0.032	-0.056	-0.065	-0.075	-0.048	0.067	-0.076	-0.060	-0.080

1. Body Mass Index
2. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 2c Mean values (normalized) of outcome scores of children aged 12 to 15 years, by family income levels

	Reading	Math	Friends score	Pro-social	Aggression	View of self	Emotional disorder	Hyper-active	BMI[1]	HUI[2] 1996	Hours of TV-self	Property offences
3-period income												
quintile 1	-0.246	-0.304	-0.163	-0.116	0.061	-0.115	0.030	0.107	0.108	-0.165	-0.116	0.022
quintile 2	0.020	-0.068	-0.020	-0.003	-0.007	-0.074	0.054	0.054	0.095	-0.041	0.050	0.079
quintile 3	-0.053	-0.032	0.033	-0.020	0.056	-0.021	0.066	0.074	-0.046	0.045	-0.0003	0.003
quintile 4	0.114	0.226	0.092	0.071	-0.017	0.049	0.022	-0.052	-0.008	0.004	-0.133	-0.003
quintile 5	0.256	0.343	0.092	0.110	-0.158	0.285	-0.288	-0.317	-0.194	0.250	-0.160	-0.176
Current low income												
low 1998	-0.093	-0.254	-0.091	-0.003	0.060	-0.127	0.064	0.149	0.066	-0.114	0.296	0.079
high 1998	0.015	0.040	0.016	0.0005	-0.010	0.022	-0.011	-0.025	-0.011	0.022	-0.052	-0.014
Number of times low income												
3	-0.238	-0.489	-0.134	-0.065	0.039	-0.053	0.091	0.162	0.071	-0.211	0.398	0.034
2	-0.260	-0.193	-0.188	-0.243	0.193	-0.184	-0.008	0.115	0.114	-0.088	0.027	0.136
1	-0.171	-0.028	-0.131	-0.061	-0.017	-0.114	0.088	0.061	0.050	-0.123	0.138	0.104
0	0.084	0.081	0.060	0.045	-0.024	0.047	-0.023	-0.042	-0.027	0.059	-0.072	-0.036

1. Body Mass Index
2. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 3a Mean values (normalized) of outcome scores of children aged 4 to 7 years, in married couple households only, by family income levels

	PPVT[1]	Reading	Math	Pro-social	Aggression	Emotional disorder	Hyperactive	BMI[2]	HUI[3] 1996	Hours of TV	Property offences
3-period income											
quintile 1	-0.383	-0.337	-0.243	-0.131	0.009	-0.064	0.073	0.067	0.020	0.200	0.047
quintile 2	-0.132	3.68e-06	0.190	-0.022	0.075	-0.049	0.007	0.082	-0.045	0.132	0.026
quintile 3	0.070	0.011	-0.085	0.066	-0.032	-0.029	-0.038	-0.054	0.122	-0.094	-0.068
quintile 4	0.243	0.118	0.109	0.058	-0.099	-0.024	-0.070	-0.065	0.106	-0.222	-0.032
quintile 5	0.556	0.286	0.325	-0.067	-0.160	0.054	-0.127	-0.216	0.041	-0.428	-0.183
Current low income											
low 1998	-0.385	-0.157	-0.261	-0.147	0.061	-0.095	0.093	0.043	0.026	0.323	0.131
not low 1998	0.094	0.032	0.102	0.011	-0.034	-0.020	-0.053	-0.029	0.046	-0.095	-0.051
Number of times in low income											
3	-0.470	-0.098	-0.412	-0.262	0.166	-0.106	0.133	0.096	-0.079	0.432	0.206
2	-0.407	-0.432	-0.255	-0.123	-0.080	-0.074	0.103	0.079	-0.004	0.191	-0.011
1	-0.175	0.014	0.168	0.040	-0.002	-0.117	-0.042	0.063	0.118	0.009	-0.008
0	0.157	0.071	0.116	0.015	-0.035	-0.004	-0.062	-0.053	0.045	-0.117	-0.053

1. Peabody Picture Vocabulary Test
2. Body Mass Index
3. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 3b Mean values (normalized) of outcome scores of children aged 8 to 11 years, in married couple households only, by family income levels

	Reading	Math	Pro-social	Aggression	Emotional disorder	Hyper-active	BMI[1]	HUI[2] 1996	Hours of TV-mom	Hours of TV-self	Property offences
3-period income											
quintile 1	-0.294	-0.041	-0.021	-0.015	0.011	-0.003	0.165	-0.0004	0.075	0.083	0.029
quintile 2	-0.194	-0.061	-0.131	0.091	-0.084	-0.007	0.010	-0.030	-0.008	-0.044	0.030
quintile 3	0.194	0.148	0.078	0.045	-0.015	0.003	-0.064	0.062	0.018	-0.004	-0.045
quintile 4	0.137	0.161	0.141	-0.242	-0.166	-0.215	-0.085	0.167	-0.212	-0.125	-0.195
quintile 5	0.473	0.230	0.134	-0.251	-0.148	-0.305	-0.153	0.216	-0.332	-0.049	-0.265
Current low income											
low 1998	-0.206	-0.139	0.114	0.006	-0.069	0.025	0.190	0.026	0.134	-0.012	-0.025
not low 1998	0.068	0.102	0.015	-0.050	-0.073	-0.093	-0.047	0.071	-0.086	-0.031	-0.074
Number of times in low income											
3	-0.417	-0.257	0.130	0.066	-0.055	0.207	0.175	-0.058	0.315	0.217	0.223
2	-0.284	0.108	-0.093	-0.047	-0.009	-0.124	0.183	0.011	0.034	-0.214	-0.093
1	-0.011	0.058	-0.032	0.037	-0.055	-0.061	0.012	0.080	-0.120	0.082	0.004
0	0.114	0.104	0.044	-0.064	-0.084	-0.096	-0.065	0.078	-0.089	-0.041	-0.095

1. Body Mass Index
2. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 3c Mean values (normalized) of outcome scores of children aged 12 to 15 years, in married couple households only, by family income levels

	Reading	Math	Friends score	Pro-social	Aggression	View of self	Emotional disorder	Hyper-active	BMI[1]	HUI[2] 1996	Hours of TV-self	Property offences
3-period income												
quintile 1	-0.301	-0.285	-0.165	-0.030	-0.013	-0.092	0.009	0.020	0.104	-0.129	-0.057	-0.105
quintile 2	0.049	-0.056	0.057	-0.035	0.017	-0.061	0.018	0.012	0.091	0.017	-0.002	0.078
quintile 3	-0.036	0.00005	0.030	0.012	0.040	-0.028	0.063	0.044	-0.060	0.075	0.009	-0.017
quintile 4	0.142	0.137	0.084	0.086	-0.008	0.068	0.033	-0.048	0.012	0.020	-0.128	-0.019
quintile 5	0.270	0.338	0.114	0.109	-0.155	0.300	-0.294	-0.310	-0.204	0.245	-0.174	-0.184
Current low income												
low 1998	-0.127	-0.188	0.016	0.121	0.035	-0.045	0.021	0.094	0.104	-0.051	0.047	-0.027
not low 1998	0.050	0.048	0.038	0.18	-0.016	0.034	-0.021	-0.054	-0.028	0.059	-0.068	-0.032
Number of times in low income												
3	-0.512	-0.536	-0.109	-0.006	-0.003	-0.033	0.072	0.080	0.306	-0.241	0.159	-0.061
2	-0.256	-0.253	-0.188	-0.154	0.128	-0.153	0.036	0.066	-0.071	0.046	-0.127	-0.018
1	-0.163	0.061	-0.024	-0.102	-0.008	-0.039	-0.014	-0.029	-0.005	0.061	0.029	0.076
0	0.103	0.069	0.067	0.055	-0.023	0.052	-0.027	-0.057	-0.030	0.079	-0.075	-0.043

1. Body Mass Index
2. Health Utilities Index

Notes: Scores have been normalized by subtracting the group mean and dividing by standard deviation. Thus, within an age group, the mean for each outcome =0 and the standard deviation=1.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 4a Child outcomes (normalized) regressed on logarithmic income using ordinary least squares – married couple households

	Ages 4 to 7				Ages 8 to 11				Ages 12 to 15			
	1998 income	**1994 income**	**Minimum income**	**Average income**	**1998 income**	**1994 income**	**Min. income**	**Average income**	**1998 income**	**1994 income**	**Minimum income**	**Average income**
PPVT[1]	0.446* (0.060)	0.456* (0.059)	0.468* (0.058)	0.560* (0.066)	--	--	--	--	--	--	--	--
Standardized reading	0.180 (0.131)	0.203*** (0.123)	0.219*** (0.120)	0.260*** (0.141)	0.355* (0.068)	0.335* (0.066)	0.327* (0.064)	0.443* 0.061)	0.217** (0.086)	0.291* (0.069)	0.228* (0.074)	0.333* (0.080)
Standardized math	0.215*** (0.122)	0.170 (0.122)	0.231** (0.114)	0.241*** (0.133)	0.196* (0.066)	0.116*** (0.069)	0.145** (0.067)	0.197* (0.070)	0.261* (0.089)	0.325* (0.067)	0.233* (0.086)	0.366* (0.081)
Friendship score	--	--	--	--	--	--	--	--	0.118** (0.053)	0.163* (0.061)	0.127** (0.055)	0.158** (0.064)
Pro-social	0.058 (0.056)	0.117** (0.054)	0.068 (0.053)	0.086 (0.065)	0.041 (0.075)	0.079 (0.065)	0.114** (0.058)	0.105 (0.078)	0.077 (0.061)	0.153** (0.061)	0.104*** (0.061)	0.143** (0.065)
Aggression	-0.109** (0.048)	-0.066 (0.045)	-0.076*** (0.045)	-0.126** (0.053)	-0.156* (0.051)	-0.154* (0.046)	-0.167* (0.043)	-0.196* (0.051)	-0.075 (0.066)	-0.024 (0.074)	-0.058 (0.060)	-0.060 (0.081)
View of oneself	--	--	--	--	--	--	--	--	0.179* 0.057)	0.288* (0.057)	0.192* (0.054)	0.267* (0.065)
Emotional	0.009 (0.065)	0.094*** (0.054)	0.081 (0.056)	0.059 (0.068)	-0.039 (0.049)	-0.085*** (0.050)	-0.050 (0.051)	-0.090 (0.057)	-4.47e-06* (1.40e-06)	-0.181* (0.057)	-0.112** (0.056)	-0.181* (0.064)
Hyperactive	-0.131** (0.053)	-0.095*** (0.052)	-0.109** (0.051)	-0.154* (0.059)	-0.145* (0.045)	-0.194* (0.050)	-0.181* (0.048)	-0.208* (0.052)	-0.170* (0.054)	-0.197* (0.062)	-0.161* (0.059)	-0.206* (0.063)
Standardized BMI[2]	-0.122** (0.053)	-0.151* (0.045)	-0.092** (0.045)	-0.170* (0.054)	-0.145*** (0.074)	-0.167* (0.062)	-0.166* (0.061)	-0.182** (0.077)	-0.122*** (0.065)	-0.216* (0.058)	-0.168* (0.060)	-0.206* (0.065)
HUI[3] 1996	0.034 (0.061)	0.046 (0.053)	0.030 (0.052)	0.068 (0.065)	0.106* (0.035)	0.150* (0.034)	0.116* (0.030)	0.159* (0.035)	0.134* (0.050)	0.191* (0.064)	0.140** (0.055)	0.179* (0.061)
TV-mom	-0.383* (0.051)	-0.295* (0.047)	-0.329* (0.048)	-0.438* (0.051)	-0.213* (0.071)	-0.167** (0.066)	-0.192* (0.060)	-0.253* (0.067)	--	--	--	--
TV-self	--	--	--	--	-0.092 (0.087)	-0.126 (0.123)	-0.115 (0.113)	-0.111 (0.103)	-0.066 (0.080)	-0.160** (0.073)	-0.129*** (0.072)	-0.137 (0.085)
Property offences	-0.102*** (0.052)	-0.100** (0.044)	-0.103** (0.043)	-0.123** (0.053)	-0.164* (0.045)	-0.185* (0.048)	-0.176* (0.047)	-0.221* (0.051)	-0.061 (0.047)	-0.140* (0.049)	-0.090*** (0.050)	-0.118** (0.052)

-- not available for a specific age group

1. Peabody Picture Vocabulary Test
2. Body Mass Index
3. Health Utilities Index

* statistically significant at the 1% confidence level

** statistically significant at the 5% confidence level

*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 4b Child outcomes (normalized) regressed on logarithmic income using ordinary least squares – lone-mother households

	Ages 4 to 7				Ages 8 to 11				Ages 12 to 15			
	1998 income	1994 income	Minimum income	Average income	1998 income	1994 income	Min. income	Average income	1998 income	1994 income	Min. income	Average income
PPVT[1]	0.511** (0.241)	0.416** (0.181)	0.565* (0.215)	0.598* (0.225)	--	--	--	--	--	--	--	--
Standardized reading	0.334 (0.548)	0.400 (0.551)	0.397 (0.579)	0.434 (0.603)	0.401* (0.123)	0.434* (0.114)	0.348* (0.117)	0.442* (0.133)	0.098 (0.143)	0.226 (0.140)	0.176 (0.137)	0.214 (0.159)
Standardized math	1.108* (0.330)	0.994** (0.380)	0.982** (0.387)	1.121* (0.371)	0.185 (0.205)	0.374* (0.132)	0.271*** (0.155)	0.290 (0.192)	0.607* (0.207)	0.718* (0.208)	0.685* (0.207)	0.831* (0.224)
Friendship score	--	--	--	--	--	--	--	--	0.024 (0.146)	0.043 (0.141)	0.054 (0.136)	0.037 (0.159)
Pro-social	0.116 (0.147)	0.175 (0.122)	0.153 (0.165)	0.228 (0.172)	0.060 (0.202)	0.255 (0.175)	0.075 (0.178)	0.114 (0.205)	0.038 (0.114)	0.031 (0.123)	0.079 (0.119)	0.083 (0.127)
Aggression	-0.372** (0.175)	-0.278 (0.194)	-0.379*** (0.197)	-0.499** (0.207)	-0.070 (0.169)	-0.359*** (0.203)	-0.267 (0.188)	-0.187 (0.181)	0.091 (0.124)	0.056 (0.121)	0.086 (0.115)	0.068 (0.133)
View of oneself	--	--	--	--	--	--	--	--	0.001 (0.150)	-0.086 (0.150)	0.017 (0.146)	-0.042 (0.163)
Emotional	-0.250 (0.312)	-0.042 (0.213)	-0.309 (0.265)	-0.057 (0.270)	0.093 (0.184)	-0.349*** (0.180)	-0.222 (0.166)	-0.092 (0.165)	0.051 (0.158)	0.068 (0.165)	0.011 (0.153)	0.066 (0.181)
Hyperactive	-0.190 (0.172)	0.142 (0.161)	-0.090 (0.193)	-0.017 (0.192)	-0.089 (0.160)	-0.199 (0.142)	-0.238 (0.146)	-0.204 (0.154)	-0.043 (0.165)	0.025 (0.158)	0.035 (0.146)	-0.030 (0.181)
Standardized BMI[2]	-0.150 (0.169)	0.195 (0.221)	-0.013 (0.227)	-0.037 (0.235)	-0.120 (0.198)	0.092 (0.202)	0.110 (0.196)	0.010 (0.218)	-0.025 (0.149)	-0.060 (0.158)	-0.083 (0.138)	-0.003 (0.168)
HUI[3] 1996	-0.034 (0.061)	-0.046 (0.053)	0.030 (0.052)	0.068 (0.0.065)	0.442 (0.386)	0.238 (0.222)	0.262 (0.254)	0.398 (0.307)	-0.107 (0.137)	-0.137 (0.127)	-0.119 (0.136)	-0.129 (0.140)
TV-mom	-0.556* (0.178)	-0.259 (0.172)	-0.367*** (0.191)	-0.692* (0.174)	-0.315 (0.350)	-0.005 (0.403)	-0.047 (0.399)	-0.238 (0.389)	--	--	--	--
TV-self	--	--	--	--	-0.413 (0.259)	-0.479** (0.208)	-0.439** (0.202)	-0.507** (0.252)	-0.536* (0.134)	-0.492* (0.135)	-0.533* (0.128)	-0.557* (0.145)
Property offences	-0.277 (0.221)	-0.096 (0.163)	-0.333*** (0.185)	-0.269 (0.178)	0.022 (0.177)	-0.229 (0.212)	-0.148 (0.189)	-0.054 (0.157)	0.023 (0.145)	0.239*** (0.137)	0.115 (0.141)	0.112 (0.147)

-- not available for a specific age group

1. Peabody Picture Vocabulary Test

2. Body Mass Index

3. Health Utilities Index

* statistically significant at the 1% confidence level

** statistically significant at the 5% confidence level

*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5a Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 4 to 7 – married couple households

	PPVT[1]	Standardized reading	Standardized math	Pro-social	Aggression	Emotional
Linear	0.00002*	8.26e-06***	6.59e-06	7.48e-07	-3.64e-06**	1.32e-06
	(2.23e-06)	(4.97e-06)	(5.05e-06)	(2.05e-06)	(1.65e-06)	(2.12e-06)
Quadratic	0.00003*	0.00003**	0.00004**	7.26e-06	-9.53e-06*	4.02e-06
	(5.30e-06)	(0.00002)	(0.00002)	(4.66e-06)	(3.54e-06)	(4.69e-06)
	-9.90e-11***	-3.44e-10***	-4.27e-10***	-6.99e-11	6.20e-11***	-2.85e-11
	(5.39e-11)	(1.93e-10)	(2.53e-10)	(4.33e-11)	(3.27e-11)	(3.83e-11)
Cubic	0.00005*	7.91e-06	0.00003	0.00003*	-5.16e-06	8.71e-06
	(0.00001)	(0.00004)	(0.00005)	(9.78e-06)	(8.79e-06)	(9.96e-06)
	-5.43e-10*	3.68e-10	-2.32e-10	-6.05e-10*	-2.77e-11	-1.25e-10
	(1.96e-10)	(1.16e-09)	(1.37e-09)	(1.88e-10)	(1.66e-10)	(1.88e-10)
	2.18e-15**	-5.82e-15	-1.59e-15	2.73e-15*	4.54e-16	4.87e-16
	(1.03e-15)	(8.95e-15)	(1.05e-14)	(8.72e-16)	(7.88e-16)	(8.70e-16)
Log	0.560*	0.260***	0.241***	0.086	-0.126**	0.059
	(0.066)	(0.141)	(0.133)	(0.065)	(0.053)	(0.068)
Quintiles	0.251**	0.337***	0.433***	0.109	0.066	0.014
	(0.098)	(0.189)	(0.255)	(0.090)	(0.086)	(0.076)
	0.453*	0.348**	0.159	0.197**	-0.041	0.035
	(0.098)	(0.175)	(0.213)	(0.090)	(0.081)	(0.078)
	0.626*	0.455**	0.353***	0.189**	-0.109	0.040
	(0.103)	(0.227)	(0.214)	(0.094)	(0.084)	(0.093)
	0.939*	0.623**	0.568*	0.064	-0.169***	0.118
	(0.136)	(0.250)	(0.221)	(0.128)	(0.090)	(0.149)
Number of times in low income	-0.332*	-0.056	0.052	0.0246	0.033	-0.113***
	(0.100)	(0.173)	(0.222)	(0.078)	(0.076)	(0.067)
	-0.564*	-0.502*	-0.371***	-0.138	-0.045	-0.070
	(0.110)	(0.174)	(0.205)	(0.106)	(0.092)	(0.088)
	-0.627*	-0.168	-0.529***	-0.277**	0.201***	-0.103
	(0.124)	(0.239)	(0.309)	(0.135)	(0.121)	(0.123)

1. Peabody Picture Vocabulary Test

* statistically significant at the 1% confidence level

** statistically significant at the 5% confidence level

*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5a Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 4 to 7 – married couple households (concluded)

	Hyperactive	Standardized BMI[1]	HUI[2] 1996	TV-Mom	Property offences
Linear	-4.78e-06*	-5.30e-06*	6.75e-07	-0.00001*	-3.13e-06***
	(1.72e-06)	(1.53e-06)	(2.37e-06)	(1.53e-06)	(1.67e-06)
Quadratic	-6.90e-06***	-9.05e-06**	0.00001**	-0.00003*	-0.00001**
	(3.95e-06)	(3.64e-06)	(5.58e-06)	(3.52e-06)	(4.06e-06)
	2.24e-11	3.86e-11	-1.23e-10**	1.38e-10*	7.63e-11***
	(3.25e-11)	(2.62e-11)	(6.05e-11)	(2.72e-11)	(4.14e-11)
Cubic	-7.41e-06	-6.39e-06	6.36e-06	-0.00003*	-0.00001
	(9.08e-06)	(8.03e-06)	(0.00001)	(7.74e-06)	(8.47e-06)
	3.28e-11	-1.59e-11	-5.61e-12	2.72e-10**	7.45e-11
	(1.68e-10)	(1.42e-10)	(2.32e-10)	(1.30e-10)	(1.56e-10)
	-5.28e-17	2.72e-16	-6.16e-16	-6.75e-16	8.90e-18
	(7.82e-16)	(6.60e-16)	(1.30e-16)	(5.82e-16)	(7.60e-16)
Log	-0.154*	-0.170*	0.067	-0.438*	-0.123**
	(0.059)	(0.054)	(0.065)	(0.051)	(0.053)
Quintiles	-0.065	0.015	-0.065	-0.069	-0.022
	(0.092)	(0.108)	(0.098)	(0.083)	(0.086)
	-0.111	-0.121	0.102	-0.294*	-0.115
	(0.083)	(0.094)	(0.087)	(0.078)	(0.079)
	-0.143***	-0.132	0.086	-0.422*	-0.079
	(0.085)	(0.095)	(0.099)	(0.082)	(0.082)
	-0.290*	-0.283*	0.021	-0.628*	-0.230**
	(0.112)	(0.108)	(0.106)	(0.095)	(0.092)
Number of times in low income	0.020	0.116	0.072	0.126	0.046
	(0.081)	(0.083)	(0.077)	(0.080)	(0.080)
	0.165***	0.133	-0.050	0.308*	0.042
	(0.090)	(0.121)	(0.110)	(0.105)	(0.092)
	0.195	0.150	-0.125	0.549*	0.259***
	(0.140)	(0.147)	(0.141)	(0.126)	(0.134)

1. Body Mass Index
2. Health Utilities Index

* statistically significant at the 1% confidence level
** statistically significant at the 5% confidence level
*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5b Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 8 to 11 – married couple households

	Standardized reading	Standardized math	Pro-social	Aggression	Emotional
Linear	9.93e-06*	4.64e-06*	7.49e-07	-4.87e-06*	-2.45e-06***
	(1.63e-06)	(1.41e-06)	(2.13e-06)	(1.29e-06)	(1.27e-06)
Quadratic	0.00001*	6.00e-06**	6.46e-06***	-7.44e-06*	-2.49e-06
	(2.83e-06)	(3.04e-06)	(3.38e-06)	(2.25e-06)	(2.34e-06)
	-2.47e-11*	-7.15e-12	-3.66e-11*	1.66e-11**	2.69e-13
	(9.36e-12)	(9.17e-12)	(1.36e-11)	(7.49e-12)	(8.00e-12)
Cubic	0.00003*	0.00001***	0.00002*	-0.00001**	-5.23e-06
	(5.87e-06)	(6.42e-06)	(6.22e-06)	(4.33e-06)	(5.26e-06)
	-2.32e-10*	-9.43e-11	-2.09e-10*	5.93e-11	3.60e-11
	(6.70e-11)	(6.95e-11)	(7.47e-11)	(4.72e-11)	(5.67e-11)
	5.00e-16*	2.10e-16	4.21e-16**	-1.05e-16	-8.77e-17
	(1.51e-16)	(1.55e-16)	(1.73e-16)	(1.07e-16)	(1.27e-16)
Log	0.443*	0.197*	0.105	-0.196*	-0.090
	(0.061)	(0.070)	(0.078)	(0.051)	(0.057)
Quintiles	0.100	-0.020	-0.110	0.106	-0.095
	(0.121)	(0.122)	(0.085)	(0.099)	(0.087)
	0.487*	0.188	0.099	0.060	-0.026
	(0.139)	(0.130)	(0.090)	(0.079)	(0.095)
	0.430*	0.202	0.163	-0.227*	-0.177***
	(0.118)	(0.140)	(0.123)	(0.070)	(0.095)
	0.767*	0.271***	0.155	-0.236*	-0.159
	(0.101)	(0.149)	(0.136)	(0.092)	(0.114)
Number of times in low income	-0.125	-0.046	-0.075	0.101	0.030
	(0.131)	(0.109)	(0.087)	(0.092)	(0.087)
	-0.399*	0.004	-0.137	0.017	0.075
	(0.119)	(0.177)	(0.096)	(0.077)	(0.090)
	-0.532*	-0.361*	0.087	0.130	0.030
	(0.126)	(0.102)	(0.137)	(0.116)	(0.175)

* statistically significant at the 1% confidence level

** statistically significant at the 5% confidence level

*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5b Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 8 to 11 – married couple households (concluded)

	Hyperactive	Standardized BMI[1]	HUI[2] 1996	TV-mom	TV-self	Property offences
Linear	-5.43e-06*	-3.54e-06**	4.01e-06*	-5.83e-06*	-2.70e-06	-5.10e-06*
	(1.09e-06)	(1.60e-06)	(8.16e-07)	(1.85e-06)	(1.84e-06)	(1.13e-06)
Quadratic	-7.01e-06*	-5.54e-06***	6.04e-06*	-0.00001*	-3.29e-06	-8.00e-06*
	(2.08e-06)	(2.97e-06)	(1.39e-06)	(4.15e-06)	(4.17e-06)	(2.01e-06)
	1.02e-11	1.24e-11	-1.08e-06*	6.15e-11**	3.00e-12	1.88e-11*
	(7.09e-12)	(1.08e-11)	(-1.08e-11)	(2.93e-11)	(1.22e-11)	(7.21e-12)
Cubic	-8.04e-06***	-0.00001**	6.04e-06***	-0.00003**	-1.19e-06	-0.00001**
	(4.73e-06)	(7.26e-06)	(3.32e-06)	(0.00001)	(9.53e-06)	(4.66e-06)
	2.36e-11	1.29e-10	-1.31e-11	3.13e-10	-2.49e-11	6.33e-11
	(4.71e-11)	(8.41e-11)	(3.20e-11)	(2.11e-10)	(9.46e-11)	(4.57e-11)
	-3.27e-17	-2.84e-16	-9.75e-21	-1.21e-15	6.62e-17	-1.09e-16
	(1.02e-16)	(1.92e-16)	(6.77e-17)	(9.62e-16)	(2.04e-16)	(9.84e-17)
Log	-0.208*	-0.182**	0.159*	-0.253*	-0.111	-0.221*
	(0.052)	(0.077)	(0.035)	(0.067)	(0.103)	(0.051)
Quintiles	-0.004	-0.155	-0.030	-0.083	-0.127	0.001
	(0.090)	(0.145)	(0.070)	(0.101)	(0.199)	(0.101)
	0.005	-0.229	0.062	-0.057	-0.087	-0.074
	(0.101)	(0.144)	(0.060)	(0.131)	(0.202)	(0.103)
	-0.212**	-0.250	0.167**	-0.287*	-0.207	-0.224**
	(0.093)	(0.154)	(0.067)	(0.094)	(0.198)	(0.095)
	-0.303*	-0.318**	0.216*	-0.408*	-0.132	-0.294*
	(0.100)	(0.153)	(0.071)	(0.123)	(0.245)	(0.104)
Number of times in low income	0.035	0.076	0.002	-0.031	0.123	0.099
	(0.084)	(0.083)	(0.065)	(0.115)	(0.248)	(0.092)
	-0.028	0.247	-0.067	0.123	-0.173	0.003
	(0.100)	(0.212)	(0.066)	(0.116)	(0.161)	(0.116)
	0.302***	0.240	-0.135	0.404*	0.258	0.318***
	(0.159)	(0.227)	(0.097)	(0.147)	(0.240)	(0.163)

1. Body Mass Index
2. Health Utilities Index

* statistically significant at the 1% confidence level
** statistically significant at the 5% confidence level
*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5c Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 12 to 15 – married couple households

	Standardized reading	Standardized math	Friends score	Pro-social	Aggression	View of oneself
Linear	8.65e-06*	0.00001*	4.09e-06*	4.74e-06*	-1.63e-06	7.72e-06*
	(1.88e-06)	(1.98e-06)	(1.55e-06)	(1.69e-06)	(2.68e-06)	(1.57e-06)
Quadratic	0.00001***	0.00001**	5.95e-06	4.96e-08	-2.18e-06	8.33e-06***
	(6.20e-06)	(6.17e-06)	(5.08e-06)	(4.48e-06)	(5.15e-06)	(4.37e-06)
	-3.22e-11	-2.66e-11)	-1.68e-11	4.20e-11	4.91e-12	-5.56e-12
	(4.82e-11)	(5.10e-11)	(3.92e-11)	(3.46e-11)	(5.47e-11)	(3.43e-11)
Cubic	0.00002***	0.00002	9.68e-06	7.91e-06	-0.00001	0.00001
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00002)	(0.00001)
	-2.77e-10	-1.69e-10	-9.44e-11	-1.21e-10	2.59e-10	-4.90e-11
	(2.66e-10)	(2.63e-10)	(2.31e-10)	(2.57e-10)	(3.28e-10)	(2.47e-10)
	1.32e-15	7.68e-16	4.16e-16	8.70e-16	-1.36e-15	2.33e-16
	(1.41e-15)	(1.40e-15)	(1.20e-15)	(1.31e-15)	(1.67e-15)	(1.23e-15)
Log	0.333*	0.366*	0.158**	0.148**	-0.060	0.267*
	(0.080)	(0.081)	(0.064)	(0.065)	(0.081)	(0.065)
Quintiles	0.349**	0.229	0.221***	-0.006	0.030	0.031
	(0.178)	(0.144)	(0.118)	(0.122)	(0.094)	(0.114)
	0.265	0.215**	0.195	0.042	0.053	0.064
	(0.163)	(0.127)	(0.122)	(0.118)	(0.086)	(0.118)
	0.443*	0.421*	0.249***	0.115	0.005	0.161
	(0.162)	(0.136)	(0.128)	(0.121)	(0.106)	(0.124)
	0.571*	0.623*	0.279***	0.139	-0.142	0.392*
	(0.181)	(0.160)	(0.143)	(0.132)	(0.119)	(0.123)
Number of times in low income	-0.266	-0.008	-0.091	-0.157***	0.014	-0.091
	(0.168)	(0.174)	(0.085)	(0.090)	(0.072)	(0.091)
	-0.359***	-0.322***	-0.255	-0.209	0.151	-0.204
	(0.193)	(0.170)	(0.213)	(0.164)	(0.133)	(0.177)
	-0.615*	-0.605*	-0.176	-0.062	0.019	-0.085
	(0.154)	(0.155)	(0.124)	(0.122)	(0.117)	(0.138)

* statistically significant at the 1% confidence level
** statistically significant at the 5% confidence level
*** statistically significant at the 10% confidence level
Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 5c Child outcomes (normalized) regressed on average income in various functional forms using ordinary least squares, ages 12 to 15 – married couple households (concluded)

	Emotional disorder	Hyperactivity	Standardized BMI[1]	HUI[2] 1996	TV-self	Property offences
Linear	-6.42e-06*	-6.24e-06*	-5.80e-06*	4.62e-06*	-4.45e-06***	-3.94e-06*
	(1.66e-06)	(1.54e-06)	(1.48e-06)	(1.23e-06)	(2.41e-06)	(1.16e-06)
Quadratic	-2.78e-07	-6.48e-06	-3.63e-06	8.06e-06***	-4.15e-07	-1.71e-06
	(4.29e-06)	(4.54e-06)	(4.67e-06)	(-3.18e-11)	(6.37e-06)	(3.98e-06)
	-5.75e-11***	2.21e-12	-1.91e-11	-3.18e-11	-3.67e-11	-1.99e-11
	(3.43e-11)	(3.61e-11)	(3.51e-11)	(3.56e-11)	(5.81e-11)	(3.02e-11)
Cubic	9.22e-06	8.84e-06	-2.35e-06	0.0001	-4.80e-06	5.01e-06
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
	-2.56e-10	-3.15e-10	-4.50e-11	-1.60e-10	5.40e-11	-1.59e-10
	(2.17e-10)	(2.41e-10)	(2.26e-10)	(2.21e-10)	(2.61e-10)	(1.97e-10)
	1.08e-15	1.69e-15	1.36e-16	6.91e-16	-4.85e-16	7.42e-16
	(1.13e-15)	(1.23e-15)	(1.13e-15)	(1.06e-15)	(1.45e-15)	(9.63e-16)
Log	-0.181*	-0.206*	-0.206*	0.179*	-0.137	-0.118**
	(0.064)	(0.063)	(0.065)	(0.061)	(0.085)	(0.052)
Quintiles	0.008	-0.008	-0.013	0.146	0.054	0.182***
	(0.092)	(0.115)	(0.120)	(0.126)	(0.129)	(0.095)
	0.053	0.024	-0.164	0.204***	0.065	0.088
	(0.090)	(0.113)	(0.116)	(0.124)	(0.123)	(0.088)
	0.023	-0.068	-0.093	0.149	-0.071	0.086
	(0.106)	(0.125)	(0.120)	(0.140)	(0.130)	(0.124)
	-0.303*	-0.330*	-0.308**	0.374*	-0.118	-0.079
	(0.107)	(0.119)	(0.131)	(0.125)	(0.165)	(0.090)
Number of times in low income	0.012	0.028	0.025	-0.139	0.104	0.119
	(0.100)	(0.096)	(0.120)	(0.086)	(0.099)	(0.101)
	0.062	0.123	-0.041	-0.033	-0.053	0.026
	(0.103)	(0.159)	(0.106)	(0.098)	(0.182)	(0.131)
	0.099	0.137	0.336***	-0.320	0.234	-0.018
	(0.125)	(0.162)	(0.181)	(0.302)	(0.151)	(0.103)

1. Body Mass Index
2. Health Utilities Index

* statistically significant at the 1% confidence level

** statistically significant at the 5% confidence level

*** statistically significant at the 10% confidence level

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 6 Ramsey Reset Test average income, null hypothesis: no omitted variables F-score (P-value in parentheses) married couple households

	PPVT[1]	Reading	Math	Pro-social	Friends score	Aggres-sion	View of oneself	Emo-tional	Hyper-active	BMI[2]	HUI[3] 96	TV-mom	TV - self	Property offences
4 to 7														
Linear	4.74 (0.003)	1.92 (0.126)	1.19 (0.313)	3.56 (0.014)	--	1.87 (0.133)	--	0.26 (0.853)	0.19 (0.904)	1.32 (0.268)	2.51 (0.057)	14.78 (0.000)	--	1.37 (0.249)
Logged	0.15 (0.927)	1.24 (0.294)	0.51 (0.674)	2.94 (0.032)	--	1.41 (0.238)	--	1.36 (0.252)	0.21 (0.890)	0.97 (0.405)	1.14 (0.333)	2.37 (0.068)	--	0.62 (0.604)
Quadratic	1.72 (0.16)	0.88 (0.452)	0.92 (0.430)	5.58 (0.001)	--	0.84 (0.473)	--	0.43 (0.729)	0.39 (0.761)	0.28 (0.837)	3.44 (0.016)	0.68 (0.563)	--	0.87 (0.453)
Cubic	1.27 (0.283)	2.38 (0.069)	1.93 (0.123)	0.36 (0.783)	--	1.31 (0.268)	--	2.10 (0.098)	0.32 (0.812)	0.52 (0.665)	4.77 (0.003)	0.93 (0.426)	--	0.74 (0.529)
8 to 11														
Linear	--	6.67 0.000)	0.64 (0.588)	7.43 (0.0000	--	2.35 (0.070)	--	0.36 (0.780)	0.95 (0.416)	1.14 (0.333)	29.69 (0.000)	1.63 (0.181)	0.51 (0.673)	5.37 (0.001)
Logged	--	10.81 (0.000)	1.21 (0.304)	5.91 (0.001)	--	0.94 (0.422)	--	2.54 (0.055)	1.23 (0.295)	0.71 (0.547)	1.42 (0.235)	0.72 (0.537)	0.79 (0.499)	0.08 (0.971)
Quadratic	--	8.06 (0.000)	1.85 (0.136)	4.61 (0.003)	--	1.28 (0.280)	--	0.32 (0.729)	0.21 (0.887)	0.93 (0.425)	0.49 (0.692)	3.27 (0.021)	0.42 (0.741)	0.45 (0.720
Cubic	--	1.48 (0.218)	0.29 (0.835)	15.28 (0.000)	--	0.92 (0.430)	--	0.39 (0.762)	0.17 (0.920)	0.69 (0.556)	0.69 (0.560)	1.55 (0.200)	0.92 (0.430)	0.10 (0.961)
12 to 15														
Linear	--	4.79 (0.003)	0.78 (0.508)	0.36 (0.784)	0.54 (0.658)	0.84 (0.473)	0.20 (0.893)	1.63 (0.181)	0.85 (0.466)	1.29 (0.277)	0.69 (0.558)	--	0.22 (0.880)	0.35 (0.787)
Logged	--	2.12 (0.095)	0.79 (0.501)	2.07 (0.102)	0.52 (0.666)	0.23 (0.878)	3.10 (0.026)	5.24 (0.001)	2.16 (0.091)	2.34 (0.072)	0.13 (0.942)	--	0.78 (0.506)	2.52 (0.056)
Quadratic	--	2.09 (0.100)	0.42 (0.736)	0.30 (0.829)	0.43 (0.733)	0.88 (0.451)	0.35 (0.793)	2.60 (0.051)	1.26 (0.284)	1.50 (0.213)	0.90 (0.441)	--	0.33 (0.802)	0.85 (0.464)
Cubic	--	18.22 (0.000)	9.38 (0.000)	0.23 (0.877)	0.60 (0.614)	1.00 (0.391)	0.42 (0.737)	0.65 (0.583)	0.27 (0.845)	1.12 (0.339)	0.19 (0.903)	--	0.84 (0.470)	1.03 (0.380)

1. Peabody Picture Vocabulary Test
2. Body Mass Index
3. Health Utilities Index

-- not available for a specific age group

Notes: The null hypothesis for the Reset test is that the model is correctly specified. Thus, if we reject the null, the test indicates that the functional form is inappropriate.

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Table 7 Summary table of best-fitting functional forms

		Ages 4 to 7	Ages 8 to 11	Ages 12 to 15
Cognitive	PPVT[1]	Cubic / Log	--	--
	Reading	Quadratic / Quintiles	Quintiles	Log
	Math	Quadratic / Log / Low income	Linear / Log	Linear / Log
Social	Pro-social	Cubic	Quintiles	Linear
	Friends	--	--	Linear /Log
	Aggression	Quadratic / Quintiles	Cubic / Quintiles	No apparent relationship
Emotional	View of oneself	Quadratic / Quintile	Cubic / Quintile	No apparent relationship
	Emotion	No apparent relationship	Linear / Quintiles	Linear
	Hyperactivity	Linear / Log / Quintiles	Linear	Linear
Physical	BMI[2]	Linear / Log / Quintiles	Log / Quintiles	Linear
	HUI[3]	No apparent relationship	Quadratic	Linear / Log
Behavioural	TV hours- reported by mother	Quadratic	Log	--
	TV hours – reported by self	--	No apparent relationship	Linear
	Property offences	Quadratic / Quintiles	Quadratic / Log	Linear

1. Peabody Picture Vocabulary Test
2. Body Mass Index
3. Health Utilities Index

-- not available for a specific age group

Source: Calculations by authors based on data from the National Longitudinal Survey of Children and Youth (NLSCY).

Appendix 1

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
PPVT-Peabody Picture Vocabulary Test (CPPCS01)	Not applicable	The variable was used to measure school readiness. The child looked at pictures on an easel and identified the picture which matched the word the interviewer read out. The standard score takes account of the child's age. Standard scores for a test are usually developed based on the distribution of scores obtained by some defined sample of individuals. This is called the norm sample. For the PPVT-R individuals in the norm sample were assigned standard scores so the mean of the standard scores was 100 and the standard deviation was 15 for all age groupings. This standardization was done by 2 month age groups.	40-160, a higher score indicating school readiness	4-7
Standardized reading score (CRECS02)	Not applicable	This score is a scaled score derived using item response theory (IRT) from the pattern of correct answers for each combination of grade and test levels. Scores on this variable increase as the child's grade level and ability increase. The score is not only based on the "raw score" but it is also a function of the level of difficulty of the items that the child answered correctly.	61-361, a higher score indicating a higher number of correct answers	8-15
Standardized math score (CMACS02)	Not applicable	This score is an equal interval score derived from the raw score for each combination of grade and test level. Scores on this variable increase as the child's grade level and ability increase.	215-871, a higher score indicating a higher number of correct answers	8-15
Friends score (CFFCS01)	CFFCQ01 CFFCQ02 CFFCQ03	I have many friends I get along easily with others my age Others my age want me to be their friend	0-16, a high score indicating positive relationships with friends	10-15

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
	CFFCQ04	Most others my age like me		
Pro-social behaviour score (CBECS07)	CBECQ6A	How often would you say that *"fname"* shows sympathy to someone who has made a mistake?	0-20, a high score indicating pro-social behaviour	4-11
	CBECQ6D	How often would you say that *"fname"* will try to help someone who has been hurt?		
	CBECQ6H	How often would you say that *"fname"* volunteers to help clear up a mess someone else has made?		
	CBECQ6U	How often would you say that *"fname"* offers to help other children (friend, brother, or sister) who are having difficulty with a task?		
	CBECQ6M	How often would you say that *"fname"* if there is a quarrel or dispute, will try to stop it?		
	CBECQ6BB	How often would you say that *"fname"* comforts a child (friend, brother or sister) who is crying or upset?		
	CBECQ6GG	How often would you say that *"fname"* spontaneously helps pick up objects which someone else has dropped?		
	CBECQ6OO	How often would you say that *"fname"* will invite other children to join in a game?		
	CBECQ6SS	How often would you say that *"fname"* helps other children (friend, brother or sister) who are feeling sick?		
	CBECQ6UU	How often would you say that *"fname"* helps those who do not do as well as "he/she" does?		
Pro-social score (CFBCS05)	CFBCQ01A	I show sympathy to (I feel sorry for) someone who has made a mistake.	0-20, a high score indicating the presence of a pro-social behaviour	10-15

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
	CFBCQ01D	I try to help someone who has been hurt.		
	CFBCQ01H	I offer to help clear up a mess someone else has made.		
	CFBCQ01M	If there is an argument, I try to stop it.		
	CFBCQ01U	I offer to help other young people (friend, brother or sister) who are having difficulty with a task.		
	CFBCQ1BB	I comfort another young person (friend, brother, or sister) who is crying or upset.		
	CFBCQ1GG	I help to pick up things which another young person (friend, brother, or sister) has dropped.		
	CFBCQ01OO	When I am playing with others, I will invite bystanders to join in a game.		
	CFBCQ1SS	I help other people my age (friends, brothers, or sisters) who are feeling sick.		
	CFBCQ1UU	I encourage other people my age who cannot do things as well as I can.		
Conduct disorder-physical aggression score (CBECS09)	CBECQ6G	How often would you say that *"fname"* gets into many fights?	0-12, a high score indicating behaviours associated with conduct disorders and physical aggression	4-11
	CBECQ6X	How often would you say that *"fname"* reacts with anger and fighting?		
	CBECQ6AA	How often would you say that *"fname"* physically attacks people?		
	CBECQ6FF	How often would you say that *"fname"* threatens people?		
	CBECQ6JJ	How often would you say that *"fname"* is cruel, bullies or is mean to others?		

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
	CBECQ6NN	How often would you say that *"fname"* kicks, bites, hits other children?		
Indirect aggression score (CFBCS01)	CFBCQ01J	When I am mad at someone, I try to get others to dislike him/her.	0-10, a high score indicating the presence of indirect aggression	10-15
	CFBCQ01R	When I am mad at someone, I become friends with another as revenge.		
	CFBCQ01Z	When I am mad at someone, I say bad things behind his/her back.		
	CFBCQ1LL	When I am mad at someone, I say to others: let's not be with him/her.		
	CFBCQ1TT	When I am mad at someone, I tell that person's secrets to a third person.		
Emotional disorder-anxiety score (CBECS08)	CBECQ6F	How often would you say that *"fname"* seems to be unhappy, sad or depressed?	0-16, a higher score indicating the presence of behaviours associated with anxiety and emotional disorder	4-11
	CBECQ6K	How often would you say that *"fname"* is not as happy as other children?		
	CBECQ6Q	How often would you say that *"fname"* is too fearful or anxious?		
	CBECQ6V	How often would you say that *"fname"* is worried?		
	CBECQ6CC	How often would you say that *"fname"* cries a lot?		
	CBECQ6II	How often would you say that *"fname"* is miserable, unhappy, tearful, distressed?		
	CBECQ6MM	How often would you say that *"fname"* is nervous, high-strung or tense?		
	CBECQ6RR	How often would you say that *"fname"* has trouble enjoying him/herself?		

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
Anxiety and emotional disorder score (CFBCS02)	CFBCQ01F	I am unhappy, sad or depressed.	0-16, a high score indicating the presence of anxiety or an emotional disorder	10-15
	CFBCQ01K	I am not as happy as other people my age.		
	CFBCQ01Q	I am too fearful or anxious.		
	CFBCcQ01V	I worry a lot.		
	CFBCQ1CC	I cry a lot.		
	CFBCQ1II	I feel miserable, unhappy, tearful, or distressed.		
	CFBCQ1MM	I am nervous, high-strung, or tense.		
	CFBCQ1RR	I have trouble enjoying myself.		
Hyperactivity/Inattention score (CBECS06)	CBECQ6B	How often would you say that *"fname"* can't sit still, is restless or hyperactive?	0-16, a high score indicating the presence of hyperactivity/inattentive behaviour	4-11
	CBECQ6I	How often would you say that *"fname"* is distractable, has trouble sticking to any activity?		
	CBECQ6N	How often would you say that *"fname"* fidgits?		
	CBECQ6P	How often would you say that *"fname"* can't concentrate, can't pay attention for long?		
	CBECQ6S	How often would you say that *"fname"* is impulsive, acts without thinking?		
	CBECQ6W	How often would you say that *"fname"* has difficulty awaiting turn in games or groups?		
	CBECQ6HH	How often would you say that *"fname"* cannot settle to anything for more than a few moments?		
	CBECQ6QQ	How often would you say that *"fname"* is inattentive?		

NLSCY Computed Behaviour Variables

Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
Hyperactivity/Inattention score (CFBCS04)	CFBCQ01B	I can't sit still, I am restless. or hyperactive.	0-16, a high score indicating the presence of hyperactivity/ inattention	12-15
	CFBCQ01I	I am easily distracted. I have trouble sticking to any activity.		
	CFBCQ01N	I fidget.		
	CFBCQ01P	I can't concentrate, I can't pay attention.		
	CFBCQ01S	I am impulsive, I act without thinking.		
	CFBCQ01W	I have difficulty waiting for my turn in games or group activities.		
	CFBCQ1HH	I cannot settle to anything for more than a few moments.		
	CFBCQ1QQ	I am inattentive, I have difficulty paying attention to someone.		
Health utility index (BHLCD02)	Not applicable	This variable is a generic health status index that is able to synthesize both quantitative and qualitative aspects of health. It provides a description of an individual's overall functional health, based on eight attributes: vision, hearing, speech, mobility (ability to get around), dexterity (use of hands and figures), cognition (memory and thinking), emotion (feelings), and pain and discomfort.	0-1, a higher score indicating higher overall function.	4-15
Property offence score (CBECS11)	CBECQ6C	How often would you say that *"fname"* child destroys his/her own things?	0-12, a high score indicating behaviours associated with property offences	4-11
	CBECQ6E	How often would you say that *"fname"* steals at home?		
	CBECQ6L	How often would you say that *"fname"* destroys things belonging to others?		
	CBECQ6T	How often would you say that *"fname"* tells lies or cheats?		

NLSCY Computed Behaviour Variables				
Derived score variable	Component variables	Survey questions	Score range	Age of respondents (years)
	CBECQ6DD	How often would you say that *"fname"* vandalizes?		
	CBECQ6PP	How often would you say that *"fname"* steals outside the home?		
Property offence score (CFBCS07)	CFBCQ01C	I destroy my own things.	0-12, a high score indicating behaviours associated with property offences	10-15
	CFBCQ01E	I steal at home.		
	CFBCQ01L	I destroy things belonging to my family or other young people.		
	CFBCQ01T	I tell lies or cheat.		
	CFBCQ1DD	I vandalize.		
	CFBCQ1PP	I steal outside my home.		

Appendix 2

YITS/PISA

The Youth in Transition Survey (YITS) integrated with the Programme for International Student Assessment (PISA) provides the opportunity to study the link between income and child outcomes for older children and through an alternative dataset from the National Longitudinal Survey of Children and Youth (NLSCY). One cohort is included in the survey (youths aged 15) in the first cycle which was administered in the spring of 2000. Unfortunately, household income was not available in the dataset at the time of this analysis. What is included, however, is the International Socioeconomic Index of Occupational Status (ISEI) which converts occupational information into a description of occupational status based on income. ISEI is an interval scale with values ranging from 0 to 90 with low values representing low status, and high values representing high status. (See Ganzeboom et al., 1992 for more information on the methodology). While we are able to get a measure of socioeconomic status for the students in this survey, we are unable to use the detailed methodologies we employed using the NLSCY. We can, however, analyze the data to ascertain whether there is a general link between socioeconomic status and child outcomes.

The YITS/PISA dataset includes child outcomes which can be categorized as cognitive, emotional, social, and behavioural. There are no outcomes which would fall into the physical developmental domain. Appendix 2, Table 1 gives an overview of the results both for all 15 year olds and broken down by socioeconomic quintile.[24] It should be noted that these quintiles are based on the YITS/PISA target population which is Canadian households where a 15 year old student resides. As noted in Phipps and Lethbridge (2005), examining where households with children fit in the *overall* Canadian income distribution reveals a concentration in the lower end. Since the comparable ISEI indicator is not available for all of Canada, our analysis will focus on comparisons solely within the 15 year old household socioeconomic distribution which could mitigate the effect.

An overall review of Appendix 2, Table 1 suggests child outcomes are linked to household income (or socioeconomic status) using the YITS/PISA data which is consistent with the NLSCY results. As socioeconomic status increases, child outcomes improve. It's striking that for all measures, the bottom quintile is shown to be worse off than the average child in the survey but percentage point differences varies from 7 percentage points in Math to 7.7 percentage points in English. Further, most outcomes steadily improve with socioeconomic status as one moves from lowest to highest. It's interesting that the effect across the quintiles is particularly strong for outcomes in the cognitive and behavioural while somewhat less so for social and emotional domains which fits with earlier results using the NLSCY.

Cognitive Domain

Included in the cognitive measure are indicators of who is doing very well and very poorly in Math and English when comparisons are made across quintiles. Not only are more lower income children failing Math and English when compared to those in with higher-household incomes, but far fewer are receiving a grade of 80 or more. Only about 28% of kids in the bottom quintile are receiving a grade of 80 or more in either subject while the highest income category suggests about 45% of students achieving a grade of 80 or better for Math and just over 48% for English. This is likely a strong indicator of who eventually moves on to post-secondary education. It also follows that those in the lower quintiles are less likely to complete high school as a higher percentage of kids in the bottom quintiles report failing Math and English. Computer skills are becoming more

23. Respondents are in order by the ISEI variable and divided into weighted quintiles.

essential in the workplace, particularly in higher paying occupations, and Appendix 2, Table 1 indicates lower-income children are lagging behind at least in terms of how they describe their own skill level.

Social Domain

As mentioned, Appendix 2, Table 1 indicates that the link between income and social outcomes is not as strong as cognitive or behavioural. Included in the social outcomes is whether the respondent feels he/she "gets along with teachers" which appears to increase steadily across the quintiles. However, this may also be a reflection of the cognitive domain as individuals may get along better with teachers when they are doing well in the class. Notice for the social outcomes indicating how easily the individual feels he/she can make friends, those in the middle quintile appear to rate the highest.

Emotional Domain

As with the social domain, the emotional outcomes do not strictly increase with socioeconomic status. Over 90% of 15-year-olds in all categories feel they are liked by others. Similarly, less than 10% feel lonely or not close to anyone across the top four quintiles while about 11% in the bottom category report feeling lonely or not close to anyone. It's likely the results from the emotional domain are mingled with the results from the social domain as the outcomes appear linked. For example, those who can easily make friends will likely feel less lonely. That social and emotional outcomes show similar patterns is perhaps not surprizing.

Behavioural Domain

The final developmental area represented in these data is what we are referring to as the behavioural domain. Included in this category is an indicator of those who spend no time on homework, complete homework on time, do not smoke, have had to see the principal for behavioural problems and those who read for pleasure. Again it's clear that outcomes in this category may be highly related to outcomes in other categories. Time spent on homework will presumably be correlated with the grade received. It follows that, as with the cognitive outcomes, homework indicators as well as the percentage who read for pleasure improve steadily with income. Smoking behaviours obviously have important implications for current and, perhaps more importantly, future health. Nearly 75% of those in highest quintile indicate they do not smoke while in the bottom quintile the percentage is only 68. Finally the percentage of kids who have had to visit the principal's office in the past year is about 30% overall with 27.3% in the highest-income category and nearly 33% in the lowest.

Conclusions YITS/PISA Data

Including information on the Youth in Transition Survey and the Programme for International Student Assessment in this report allows the study of the link between income and child outcomes for older children through an alternative dataset to the NLSCY. Unfortunately, household income was not available in the dataset at the time of this analysis, so it is difficult to make direct comparisons with the NLSCY results. However, a socioeconomic index is included which is constructed from the occupations of the parents and provides a measure which is highly correlated with actual income. Using quintiles based on this index and simple means on student variables, we can make some general conclusions which we can compare to the NLSCY results.

Overall the data suggest there is a link between household income and child outcomes where the well-being of children appears to increase with increasing socioeconomic status.

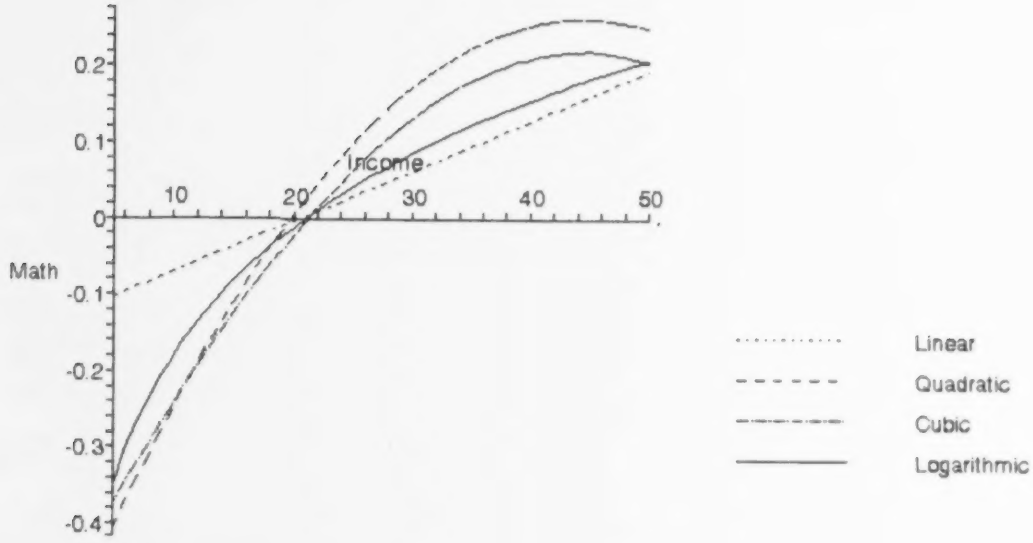
This conclusion is consistent with the general results from the NLSCY as well as previous literature. The strongest relationships appear to be in the cognitive and behavioural domains while the social and emotional domains suggest that lower-income children are worse off to some extent, the relationship does not appear as strong as outcomes do not necessarily increase with income. As with the NLSCY results included in this report, the actual functional form may be key to understanding the exact relationship with income among the variables. Future waves of the YITS/PISA data will include actual household income enabling researchers to provide a more in-depth analysis and more direct comparisons with the NLSCY.

Appendix 2 Table 1
YITS/PISA Child Outcomes by Quintile

		All	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Cognitive	< 50% in math	5.9%	7.7%	6.7%	6.2%	4.8%	4.2%
	<50% in English	3.0%	5.5%	2.8%	2.9%	2.3%	1.7%
	80+ in math	35.7%	28.3%	32.4%	32.9%	39.3%	44.7%
	80+ in English	38.4%	28.5%	33.3%	38.0%	43.1%	48.1%
	Fail math (PISA)	14.7%	18.2%	16.8%	15.4%	12.1%	11.2%
	Fail English (PISA)	10.4%	14.9%	11.1%	10.2%	8.9%	7.2%
	Computer skills excellent/good	77.3%	69.7%	76.0%	76.5%	80.0%	84.0%
Social	Agree difficulties making friends	13.3%	15.7%	12.7%	11.8%	13.2%	13.4%
	Gets along with teachers	71.5%	67.5%	70.0%	70.5%	74.2%	75.5%
	Agrees can make friends easily	89.8%	88.7%	89.7%	90.7%	90.5%	89.3%
Emotional	Not close to anyone	8.7%	10.7%	8.9%	8.1%	7.5%	8.6%
	Agrees he/she is liked by others	93.4%	91.5%	92.8%	94.0%	94.0%	94.5%
	Agrees he/she feels lonely	9.1%	11.1%	9.4%	8.3%	8.6%	8.3%
Behavioural	0 hours/week spent on homework	6.0%	9.2%	6.1%	6.6%	5.1%	3.1%
	Always/mostly finishes homework on time	76.0%	71.1%	74.5%	75.1%	77.6%	81.4%
	Does not currently smoke	70.8%	68.4%	68.5%	69.4%	72.7%	74.7%
	Has had to see the principal	30.1%	32.8%	31.5%	31.1%	28.1%	27.3%
	Reads for pleasure	67.3%	63.5%	64.8%	65.4%	69.3%	73.2%

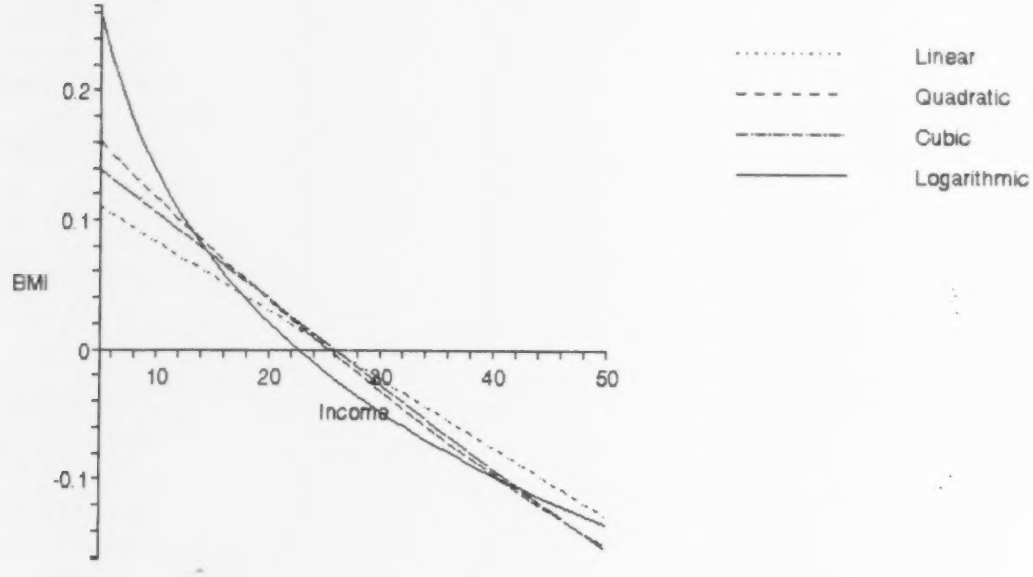
YITS = Youth in Transition Survey
PISA = Programme for International Student Assessment
Source: Statistics Canada.

Figure 1: Normalized Math Score: Ages 4 to 7



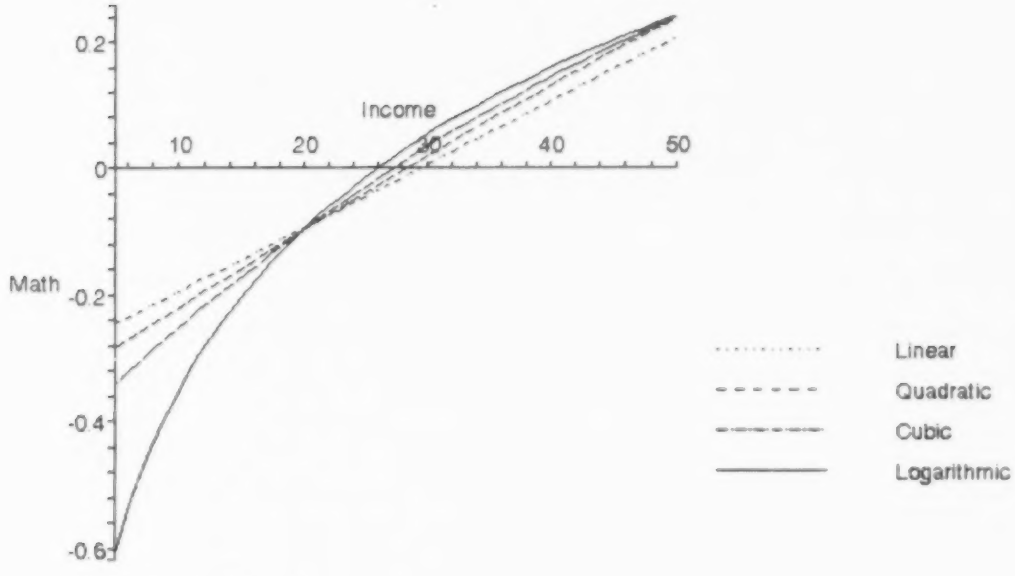
Source: Statistics Canada.

Figure 2: Normalized Body Mass Index: Ages 4 to 7



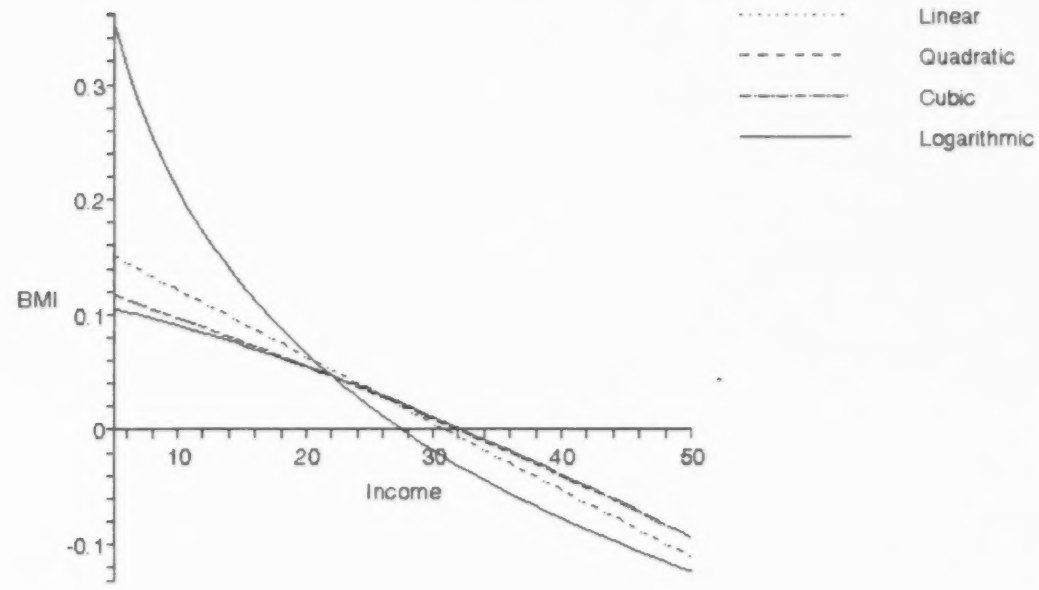
Source: Statistics Canada.

Figure 3: Normalized Math Score: Ages 12 to 15



Source: Statistics Canada.

Figure 4: Normalized Body Mass Index: Ages 12 to 15



Source: Statistics Canada.

Glossary

NLSCY: National Longitudinal Survey of Children and Youth

YITS: Youth in Transition Survey

PISA: Programme for International Student Assessment

PPVT: Peabody Picture Vocabulary Test

SES: Socioeconomic status

OCHS: Ontario Child Health Study

HUI2: Health Utilities Index Mark 2

PSID: Panel Study of Income Dynamics

SLID: Survey of Labour and Income Dynamics

LFS: Labour Force Survey

PMK: Person Most Knowledgeable

LIS: Luxembourg Income Study

SCF: Survey of Consumer Finance

HUI: Health Utilities Index

BMI: Body mass index

OLS: Ordinary least squares

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